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STATE OF CALIFORNIA
EDMUND G. BROWN, *Governor*
GLENN ANDERSON, *Lieutenant Governor*

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Volume XLIX Number 3

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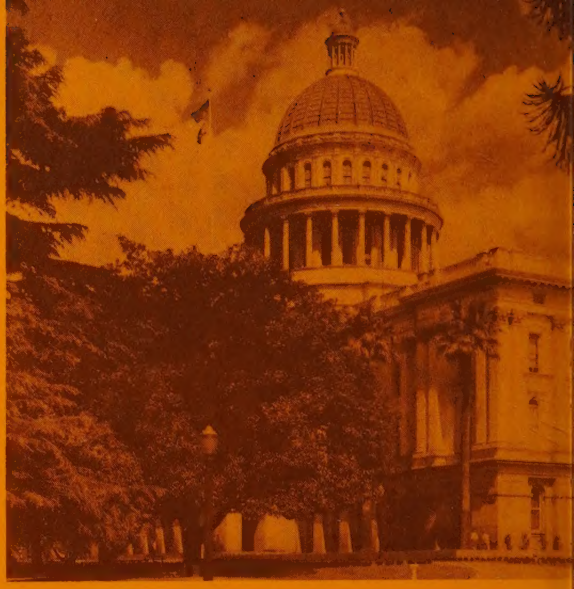

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OUR COVER: Yellow Hammer. See page 183. All drawings of the birds and animals appearing in the article on pages 177-185 were drawn by D. D. McLean. Permission for their reproduction is through the courtesy of the California Department of Fish and Game.

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DISTRIBUTION AND UNDESIRABLE CHARACTERISTICS OF CERTAIN WILD BIRDS AND ANIMALS BARRED FROM IMPORTATION OR RESTRICTED IN IMPORTATION INTO THE STATE OF CALIFORNIA

FOREWORD

By WALTER S. BALL, *Chief, Bureau of Rodent and Weed Control and Seed Inspection California Department of Agriculture*

The legislative act governing the importation of wild birds and animals into the State of California is set forth in Division 3, Chapter 2, Articles 1, 2 and 3 of the Fish and Game Code. This law is specific in its treatment of all questionable species. The joint regulations of the Fish and Game Commission and the Department of Agriculture governing the importation of wild birds and animals, and conditions under which same may be kept in confinement are set forth in Part 3, Chapter 3, Section 671, Title 14 of the California Administrative Code.

All species and families listed in the regulations could adapt themselves to California's climate and geography causing enormous economic losses to agriculture and natural resources and in some instances could be detrimental to the health and welfare of the people. There are many other groups that are even more destructive but were deemed as not being fitted to adapt themselves to California's climate and geography.

Section 2122 of the Fish and Game Code requires the Department of Fish and Game to "furnish descriptions and other explanatory illustrative material concerning the wild animals which have been designated as undesirable and a menace to the native wildlife or to the agricultural interests of this State for the information and guidance of the enforcing officers." This information is set forth in a publication entitled "Laws and Regulations Governing the Importation of Wild Birds and Animals Into the State of California and Conditions Under Which Same May Be Kept in Confinement." It contains useful descriptions of the particular species that are covered by the act.

This information is intended to supplement the descriptions in the Department of Fish and Game publication by informing enforcement personnel of the reasons why the species listed in the act and regulations are either barred or restricted.

EXCLUDED SPECIES [1]

1. EUROPEAN STARLING *Sturnus vulgaris*

Geographical Distribution: Native to most northern parts of Europe and corresponding latitudes in the western two-thirds of Siberia. Their fall migration takes them into countries bordering the Mediterranean and as far east as India. Introduced and established in Australia, Tasmania, New Zealand and most of the United States and Canada. Found wintering in large numbers in California.

Food Habits and Undesirable Characteristics: The starling secures the principal portion of its food on the ground. It feeds mainly on insects and their larva but also eats grain seeds, eggs and certain fruits especially mulberries, cherries and occasionally ripe pears, apples, grapes, corn and garden truck.

The starling has certain tendencies for harm. These have been intensifid by the bird's flocking habits as well as by a general increase in abundance in recent years. The same factor has been important in making its roosting habits objectionable in residential and business sections of cities. The starling is aggressive against native hole nesting species and will dominate an area.

(1) European Starling

2. CRESTED STARLING *Aethiopsar cristatellus*

Geographical Distribution: Native to Central and Southern China. Introduced and established in British Columbia.

Food Habits and Undesirable Characteristics: Eats worms, slugs, insects and small fruits. Does damage to young leaves of vegetables. This species of starling does a great deal of damage to agriculture in its native habitat. The birds are pugnacious and drive out native species of birds. They disfigure buildings and parks by their roosting habits.

3. COMMON MYNAH *Acridotheres tristis*

Geographical Distribution: Indigenous to India and Indo-China. Introduced into many parts of the Pacific, notably the Hawaiian Islands and South Africa.

[1] See Section 671, Title 14, California Administrative Code or Bureau of Plant Quarantine Memorandum No. 8, Part IV, Appendix Plant Quarantine Manual for excluded and restricted species.

Food Habits and Undesirable Characteristics: The common mynah was introduced into areas to control various insect pests. It destroys a certain amount of fruit and has been blamed for spreading the seeds of lantana in the Hawaiian Islands. In New Caledonia it has been reported to feed much on the ground, particularly near cattle.

It is a noisy and aggressive bird, and where it takes up quarters in villages and towns, it becomes practically a domestic bird. The common mynah is also responsible for disfiguring buildings and parks.

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(2) Crested Starling (3) Common Mynah

4. BAYA WEAVER *Ploceus baya*

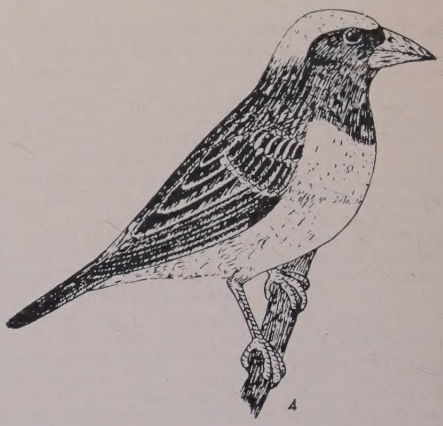
Geographical Distribution: A very common bird throughout Ceylon, India, Indo-China, Malaya. Ranges southeast to Java and Sumatra.

Food Habits and Undesirable Characteristics: Members of the weaverbird family are seed eating birds and feed voraciously on rice and other grains. Because of their gregarious nature, they are numerous in cultivated country around fields, in reed and grass areas. The English or House Sparrow belongs to this group.

5. MADAGASCAR WEAVER *Foudia madagascariensis*

Geographical Distribution: The Madagascar weaver inhabits Madagascar and many of the islands of the Seychelles Archipelago and has been introduced on the isle of St. Helena.

Food Habits and Undesirable Characteristics: It has fairly recently established itself on St. Helena and multiplied to such an extent that it has become a nuisance to the farmers. In Madagascar the birds do not frequent the forests, but are otherwise distributed over the island and as soon as the breeding season is finished, they assemble in large flocks to feed in the rice fields.



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(4) Baya Weaver (5) Madagascar Weaver

6. OPOSSUMS *(All species) Of the Family Didelphidae*

Geographical Distribution: Ranges from southern Canada throughout the eastern United States and extends well into South America. *Didelphis marsupialis virginiana,* the opossum from the eastern United States, is established in California throughout most of the counties west of the Sierra Nevada and the southeastern desert area south to Mexico. Many other members of this family are found south of the United States and throughout most of South America.

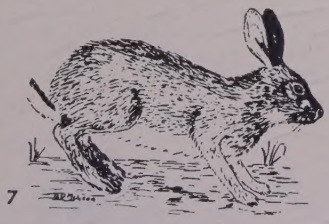
Food Habits and Undesirable Characteristics: The opossum is nearly omnivorous; its diet includes eggs, chickens, young birds, young rabbits, mice, rats, all sorts of small game, many kinds of insects, crustaceans, mollusks, frogs, salamanders, mushrooms, muskmelons, vegetables and fruit of many kinds; bacon, carrion and whatever else is conveniently at hand.

(6) Opossum

7. EUROPEAN RABBIT *Lepus cuniculus*

Geographical Distribution: Native of western half of Mediterranean Basin only and still abounds in Spain, Sardinia, southern Italy, Sicily, Greece, Tunis and Algeria and many of the islands adjoining these countries. It has spread northward across Europe and northeastward to Russia. The introduction of this rabbit into Australia and New Zealand has created one of the most serious pests the farmer has to contend against. It has been introduced into Pennsylvania and the San Juan Islands off the coast of the State of Washington.

Food Habits and Undesirable Characteristics: The European rabbit eats everything in sight. It causes severe damage to grazing lands, field crops, truck crops and orchard trees. England considers the European rabbit second only to the common rat as its most serious animal problem. It burrows holes two to eight feet deep; has been known to undermine buildings.

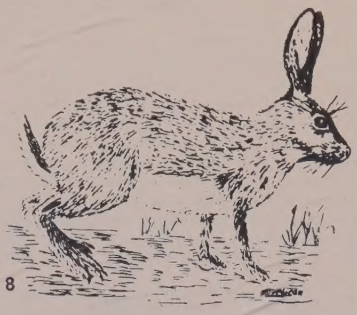


(7) European Rabbit

8. EUROPEAN HARE *Lepus europaeus*

Geographical Distribution: Native to temperate Europe and Asia. Found in the United States in the area bordering the Great Lakes extending eastward to the Atlantic Coast. Not known to occur in California.

Food Habits and Undesirable Characteristics: This species is injurious to crops, grassland and orchards. It is particularly destructive to grape vines in its eating upon new shoots. This hare takes readily to water and is a good swimmer. An extremely swift runner was checked at 45 miles per hour top speed.



(8) European Hare

9. BANK VOLE *Clethrionomys glareolus*

Geographical Distribution: Native to England and most of northern Europe and Asia.

Food Habits and Undesirable Characteristics: Food of the bank vole consists mainly of vegetation and has been known to be destructive to crops. It is usually found in the lowlands or valleys where it burrows into canals, ditch banks, levees and causes damage in that respect.

(9) Bank Vole

10. COMMON FIELD VOLE *Microtus hirtus*

Geographical Distribution: Found in England and Wales, the Isle of Wight and Anglesey and the lowlands of Scotland.

Food Habits and Undesirable Characteristics: The field vole's food consists of vegetation and it is recorded as being destructive to field crops.

(10) Common Field Vole

HIGHLAND FIELD VOLE *Microtus agrestris*

Geographical Distribution: Found in northern and central Europe including the British Isles.

A closely related species *Microtus pennsylvanicus* has the largest geographic range in North America of any of the species of the subgenus *Microtus*. Some 24 various subspecies of the *M. pennsylvanicus* extend over most of the northern states and along the eastern coast, but none are found in Oregon, California or Nevada.

Food Habits and Undesirable Characteristics: Microtus agrestris thrives in grassland areas as well as in wooded areas. In Great Britain it is one of the chief agents of tree damage in the young forests. In the forest the vole is not contented with grass and other vegetation but nibbles off bark or rings young trees. They also attack roots and branches of seedling trees. Destruction in field crops also occurs where at times voles become extremely numerous. Plague has been known to occur in *M. agrestris* in Germany.

11. WATER RAT *Arvicola amphibius*

Geographical Distribution: Found in Europe, including England but not Ireland, and in most of Asia north of the Himalayas. Found in Siberia but not known in China.

Food Habits and Undesirable Characteristics: It feeds almost exclusively on vegetable matter such as duckweed, aquatic roots or water lilies. On occasion, however, it will eat small fish, mussels and fresh water crustaceans. Water rats are at home in the water and usually make an extensive burrow system in banks. They may undermine canal embankments, levees and dams when excavating runways.

(11) Water Rat

12. LONG TAILED FIELD MOUSE *Apodemus sylvaticus*

Geographical Distribution: Found throughout Europe and Asia.

Undesirable Characteristics: This mouse is extremely adaptable and wide ranging from the low flatlands well up into the higher mountains. It is destructive to a wide variety of domestic crops, as well as stored grains, fruits and root crops.

(12) Long-tailed Field Mouse

MICE AND RATS (All Species) of the Family *Muridae*

Geographical Distribution: Members of the family Muridae are distributed in most every part of the world inhabited by man.

In North America we have at least three subspecies of the black rat which have been introduced: *Rattus rattus rattus, Rattus rattus alexandrinus,* and *Rattus rattus frugivorus.* Only one subspecies of the Norway rat occurs in North America and it is *Rattus norvegicus norvegicus.* Subspecies of the genus *Mus* that have been introduced into this country are *Mus musculus brevirostris* and *Mus musculus domesticus.* The other subspecies are not known to occur in North America.

Food Habits and Undesirable Characteristics: As a group the murids will eat most any kind of food. On the farms and ranches they destroy and pollute vast amounts of stored food stuffs. They injure growing crops. They kill poultry and livestock, and they ruin property in numerous other ways. In warehouses their damage can be overwhelming. In homes they destroy stored foods and furniture. They may weaken construction by their borings. They are four-legged firebugs, and they pollute water supplies and spread more diseases than any other animals.

Books have been written on this family and its undesirable characteristics. About the only good thing that can be said of the group is that albinistic strains of *R. norvegicus* and *M. musculus* have value as experimental animals.

13. HAMSTERS AND OLD WORLD FIELD MICE (All Species) of the Family *Cricetidae*

Geographical Distribution: Native to Europe and Asia.

Food Habits and Undesirable Characteristics: Hamsters and Old World field mice are a destructive group of rodents. This includes a vast assemblage of rodents differing widely in habits, habitats and structure. All species are or could be a menace to agriculture, in that they eat bark, grains, fruits and roots. They burrow extensively causing water loss and erosion. Golden hamsters *Mesocricetus auratus* now being raised commercially in the State and kept as pets by many people would be a source of trouble if they ever became established in the wild.

(13) Hamsters

ALL SPECIES OF THE FAMILY *SCIURIDAE*

This family includes a large group of animals, among which are chipmunks, flying squirrels, ground squirrels, tree squirrels, prairie dogs, woodchucks and other destructive species.

Eastern fox squirrels and eastern gray squirrels have already become established in parts of California causing damage to the nut crops. In the San Fernando Valley of Southern California the fox squirrel causes considerable damage to communication lines by eating off the insulation.

Such animals as the prairie dog, Franklin ground squirrel, 13-striped spermophile and the Columbian ground squirrel are all species of our own continent which are not known to exist in California. There are a host of other species scattered throughout the world which are also foreign to California.

CHIPMUNKS (All Species) Of the Genera *Eutamias* and *Tamias*

Geographical Distribution: The eastern chipmunk *Tamias* is spread over the greater part of eastern Canada and the eastern United States except Florida. It is found west of the Great Plains but here the range stops abruptly.

The western chipmunk *Eutamias* occupies all of North America west of the plains regions. Its range extends from the Yukon south into Mexico and overlaps the range of the eastern chipmunk in Ontario and Wisconsin. The Asiatic chipmunk *Eutamias sibericus* inhabits Siberia.

Food Habits and Undesirable Characteristics: The foods sought by the chipmunk are seeds, grains, nuts, berries, birds, fruit of many varieties, some insects and animal food, such as bird eggs. Chipmunks have a public health significance in that they are known to carry rodent-borne diseases which are transmittable to humans.

POCKET GOPHERS (All Species) Of the Family *Geomyidae*

Geographical Distribution: The members of this family are widely distributed in north and central America. There are over 560 species and subspecies found in this area. There are four species in California. The Botta pocket gopher contains many subspecies or geographic races in the State.

Food Habits and Undesirable Characteristics: The pocket gopher digs its way through the soil in search of food which usually consists of roots, bulbs, tubers and even green stalks of such plants as alfalfa, clover and wild oats. It digs and eats along the roots of a plant until only the stem is left. Gopher mounds cause loss by preventing close cutting of hay crops. The burrows cause erosion to steep slopes and may cause costly breaks in reservoir dams and canals. The gopher causes considerable damage to underground telephone cables and plastic pipe.

MOLES—EUROPEAN MOLE *Talpa Europaea*

Geographical Distribution: Europe from Great Britain and Channel Islands eastward, and from the Mediterranean coast to Scotland and central Sweden.

Food Habits and Undesirable Characteristics: These animals cause considerable destruction and annoyance, not that they eat vegetables, but they chew through roots of plants and raise small seedlings and plants out of the ground and ruin lawns in their wandering search for worms and other subterranean animal food. The resultant loss of water in their burrows is considerable which in turn may cause extreme soil erosion.

BATS (All Species) Of the Family *Desmodontidae*

Geographical Distribution: South America, Mexico and extreme southern Arizona, possibly Texas and New Mexico.

Food Habits and Undesirable Characteristics: Bats of this family are vampire bats and are highly specialized in their feeding, and so far as is known, eat nothing but fresh blood. The bat's sharp, sickle-shaped anterior teeth shave down, incise or scoop out a basin in the skin so adroitly that a sleeping victim is seldom disturbed. The oozing or flowing blood is eaten and the wound may bleed for several hours. The bat sometimes consumes prodigious quantities of blood at a meal at which time its body becomes almost globose, and the bat is barely capable of flight. In some tropical areas depredations by vampires on domestic animals make stock raising uneconomical. Vampire bats have been known to transmit rabies to other mammals by biting them.

FLYING FOX OR FRUIT BATS (All Species) Of the Family *Pteropodidae*

Geographical Distribution: Java, Northeast Australia, Madagascar and neighboring islands through the Seychelles to India, Ceylon, Burma, the Malay Archipelago, southern Japan, New Guinea and most of Polynesia. Also found in India.

Food Habits and Undesirable Characteristics: Fruit bats are extremely destructive to ripe fruit of every description.

14. FERRET *Mustela furio*

Geographical Distribution: *Mustela furio* is the domesticated ferret. Ferreting has been a popular sport in Europe, Asia and Africa for centuries. Ferrets have been brought into the United States, but none are known to exist in California.

Food Habits and Undesirable Characteristics: Their food consists of birds, rats, rabbits and reptiles. Because they possess long, slender bodies and a keen desire to kill, ferrets are used to drive rabbits and rats out of their holes so they can be shot or killed by dogs. Ferreting was practiced in Asia as early as the first century before Christ.

(14) Ferret

15. WEASEL *Mustela nivalis*

Geographical Distribution: Native to all continents save Australia. Not known to occur in California. (Several species of the long-tailed weasel *Mustela frenata* occur in California, except in the southeast desert region.)

Food Habits and Undesirable Characteristics: This weasel feeds primarily on mice and climbs low shrubbery to stalk birds. It has larders in crevices and holes in trees where it stores food. Weasels often travel and hunt in packs of up to eight individuals. However, it is generally one family that is involved. The weasel is known to be destructive to poultry. It bites through the skull, back of the neck or under the wing of poultry and may eat only the back of the head and neck. It sometimes kills many birds in one night and places them neatly in a pile.

(15) Weasel

STOAT *Mustela erminea*

Geographical Distribution: Northern hemisphere, south in the Old World to northern Africa, and in the New World to the Andes. In North America their range extends from the Arctic to northern Connecticut and the Great Lakes in the eastern states and slightly farther south in the Rocky Mountains and west. Some 20 subspecies occur in North America, many of which are found in the United States. Two subspecies are known to occur in Northern California, *Mustela erminea streatori* and *Mustela erminea gulosa.*

Food Habits and Undesirable Characteristics: The stoat prefers small rodents to birds or insect food. It is a powerful animal for its size and hunts over a considerable territory. In summer, at least, the food of the animal is made up of almost entirely small rodents or rabbits. Since this animal is a carnivore it may be responsible for raiding domestic chicken coops and reducing the population of both game and nongame birds.

16. MONGOOSE *Herpestes mungo*

Geographical Distribution: Native to India but have been introduced into Haiti, Cuba, Puerto Rico and other islands of the Caribbean Sea. They were also introduced into the Hawaiian Islands. Great precautions are being taken to prevent the introduction of mongooses into the United States. Many other species of *Herpestes* live in Asia and Africa. One is known to inhabit Spain.

Food Habits and Undesirable Characteristics: The mongoose will eat reptiles, birds, insects, rats and almost any other small animal, and sometimes fruit and vegetables. They are rated as excellent mousers and ratters, and for that reason they were introduced into new areas. Where introduced in the West Indies to reduce numbers of the introduced rats of the genus Rattus, the mongoose has exterminated many species of the native mammals. Now the rats persist along with the mongoose that has made a pest of itself. Hawaii has lost many of their native land birds due in part to the depredations of the mongoose, and they still have a rat problem.

(16) Mongoose

17. CRAYFISH (Crawfish, Crawdads, Freshwater Shrimp, etc.)

Genera *Cambarus* and *Astacus*

Geographical Distribution: Native to Europe and North America. Other genera are found in various parts of the world. *Cambarus affinis* is common in the eastern states, *C. virilis* and others in the Mississippi Valley and *Astacus nigrescens* occurs from San Francisco northward on the Pacific Coast. *C. Clarkii* of the gulf states has become acclimatized in Southern California. The genus *Astacus* includes five species in western North America and 10 in Europe and western Asia; *Cambarus* comprises about 70 species in North America east of the Rocky Mountains and in Central America. The various species of *Cambarus* are segregated ecologically. Some examples being *C. affinis* in ponds, lakes and slow rivers; *C. acutus* in swifter streams; *C. virilis* in large rivers; *C. bartoni* in upland streams; *C. diogenes* in marshes and meadows where it digs burrows one to three feet deep down to water and topped by "chimneys" of mud; and *C. pellucidus* which is blind and lives in water in caves.

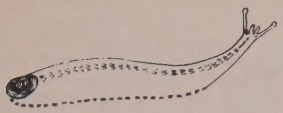
Food Habits and Undesirable Characteristics: Fresh water crayfishes of the genera *Cambarus* and *Astacus* burrow into banks and levees as well as destroy fish roe and eat small fish. The burrowing species subsist extensively on stems and roots of plants and other species use some such materials.

(17) Crayfish

18, 19. SLUGS AND SNAILS Class *Gastropoda*

Geographical Distribution: Numbering nearly 50,000 known species, snails and slugs compose the largest class (Gastropoda) of the *Phylum Mollusca* and are distributed throughout the world.

Food Habits and Undesirable Characteristics: Slugs and land snails of all species are destructive to plant life, both wild and domestic. Some species of the great land snails may eat as much as a pound of forage per night. Many snails are the necessary intermediate host for trematode flatworms.



(18) Slugs

(19) Land Snails

Restricted Species

21. YELLOW HAMMER *Emberiza citrinella*

Geographical Distribution: The home of this species is in central and northern Europe, including the British Isles and Scandanavia, extending eastward into Russia and in the winter southward to Turkey, Turkestan and Iran.

Food Habits and Undesirable Characteristics: In England its food is chiefly vegetable: corn, seeds of weeds, wild fruits, etc. It also feeds on insects and spiders. The Yellow Hammer is a prolific breeder and occasionally in late summer and fall gathers into very large flocks and invades grain lands causing considerable losses.

20. HOODED CROW *Corvus cornix*

Geographical Distribution: British Isles and all of Europe east of longitude 10 degrees; Asia north of Turkestan; Asia Minor into Afghanistan, Palestine and Asia Minor.

Food Habits and Undesirable Characteristics: In the British Isles its food consists of carrion of all kinds, wounded birds, small mammals, enormous quantities of eggs of many birds, also mollusca, insects (chiefly beetles), frogs, worms and grain. Along the coast the hooded crow feeds on dead fish and other carrion cast up by the tide.

22. CARRION CROW *Corvus corone*

Geographical Distribution: Found in all of Europe including British Isles, east through Russia to central Siberia and Japan, south to Turkestan and Black Sea area.

Food Habits and Undesirable Characteristics: In England the food of the carrion crow has been reported as being varied, including carrion, small mammals (rabbits, mice, etc.), wounded and small birds, eggs of many birds, frogs, toads, mollusca, insects (especially beetles), worms, and grain. It is believed that the carrion crow is very destructive to all forms of bird life during the nesting season.

(20) Hooded Crow (21) Yellow Hammer
(22) Carrion Crow

23. ROOK *Corvus frugilegus*

Geographical Distribution: All of Europe north, in summer, to the Arctic Circle, south in winter to northeastern Africa, Asia Minor, eastward in summer to western Siberia and Turkestan; south in winter to Iran, Afghanistan, and northwestern India.

Food Habits and Undesirable Characteristics: It is estimated that in agricultural districts in England the food of the rook consists of about 70 percent vegetable matter. Corn seems to be its main vegetable food, but at times various fruits, acorns and walnuts are taken. They have been known to unearth and peck holes in potatoes and turnips. Earthworms, insects, millipedes are also regularly taken. When quarters are taken up along the coast of England they feed on crabs, shellfish and carrion of the tide mark. The rook often eats eggs of other birds, small birds, small animals and carrion. The proportion of animal matter is highest in the summer and lowest in the winter.

(23) Rook

24. SKYLARK *Alauda arvensis*

Geographical Distribution: All of Europe and Asia. Introduced into New Zealand and Australia.

(24) Skylark

Food Habits and Undesirable Characteristics: In Britain their food consists mainly of seed; large quantities of seeds of various weeds are eaten, and damage is done to corn and leaves of root crops. Besides these, earthworms and insects, as well as millipedes, are eaten. It has been reported that the skylark eats seedling beans, lettuce, carrots, and many other garden and farm crops. Because they gather into large flocks the losses can be considerable.

25. EUROPEAN BLACKBIRD *Turdus merula*

Geographical Distribution: The European blackbird is found throughout Europe (south of the Arctic Circle) and North Africa.

Food Habits and Undesirable Characteristics: In England the food of the European blackbird consists of both vegetable and animal matter. They are very destructive to fruit, especially during a drought (apples, pears, strawberries, gooseberries, cherries, etc.). The birds also feed on many species of ornamentals (holly, cotoneaster, etc.) and the seed of many plants. In addition, they eat quantities of earthworms, insects, spiders, millipedes and small mollusca.

(25) European Blackbird

26. MISSEL THRUSH *Turdus viscivorus*

Geographical Distribution: Found in Europe, Asia and North Africa.

Food Habits and Undesirable Characteristics: In England, the food of the missel thrush consists largely of fruit and berries, but also includes mollusca, annelids, insects and spiders. They are known to kill young song-thrush and blackbirds. Besides fruit (cherries, apples, plums, black currants), many kinds of berries or seed (mistletoe, hawthorne, rose, holly, etc.) are eaten. The birds have been known to do such extensive damage as to make it necessary to cover cherry trees and berry vines with netting in order to get a satisfactory crop.

(26) Missel Thrush

27. NUTRIA *Myocaster coypus*

Geographical Distribution: Native to South America. Introduced into Europe and North America. The rearing of this fur-bearing animal is regulated by law in California. Some animals have been released or have escaped but are trapped or destroyed when found.

Food Habits and Undesirable Characteristics: The nutria is strictly herbivorous and feeds on a wide variety of succulent green plants, rushes, seeds and aquatic plant roots. It is not too particular in selecting a menu. Wherever rice, corn, sweet potatoes, and other agricultural crops are grown close to waterways, the nutria causes severe damage. They have also been known to eat the bark from around the base of trees resulting in the loss of the trees. They damage earthen dams, levees and canal banks by their burrowing habits. They are serious competitors with muskrats and frequently force them out of their marsh habitat. They destroy waterfowl habitat.

(27) Nutria or Coypu

28. MUSKRAT *Ondatra*

Geographical Distribution: *Ondatra zibethicus* is native to North America north of Mexico. Now established in many portions of California other than the original ranges. Only the one species is found in the United States, but there are some 15 subspecies, two of which are found native in California. One is found in the extreme southeastern part of the State. The other is found in that portion of California east of the Cascade-Sierra divide. The muskrat is now well established in many of the counties of the State. The muskrat has been introduced into Europe including the British Isles, and now inhabits much of the region.

Food Habits and Undesirable Characteristics: The muskrat is an aquatic, rat-like rodent. It feeds on tules, rushes, cattails, and other water growing plants. Also, it consumes various bulbs and grasses. They sometimes eat animal food, such as crayfish, mussels, tadpoles and snails, although these items seem to be rare in the muskrat's diet. The muskrats have caused considerable damage to levees and canal banks by their burrowing activities. Through their burrowing muskrats have become a real nuisance in our irrigation systems where they exist causing considerable economic loss.

(28) Muskrat

AGOUTI *Dasyprocta agouti*

Geographical Distribution: The agouti *Dasyprocta agouti* is native of tropical Americas and the West Indies from southern Mexico to Paraguay.

Food Habits and Undesirable Characteristics: The agouti feeds on leaves, roots and fallen fruit, does damage to sugar plantations. Lives in burrows or underground dens.

COATI MUNDI *Nasua narica*

Geographical Distribution: Two species of *Nasua* are found in North America, but only one, *N. narica,* is found in the United States in the States of Arizona, New Mexico and Texas. In California a coati mundi was reported caught in Marin County in the Nicasio area.

Food Habits and Undesirable Characteristics: The coati mundi feeds chiefly upon fruit and insects, but is omnivorous, taking also small mammals, birds, lizards, etc., and at times destroys poultry. Coati mundi frequently hunt in groups. They are adequate climbers and forage in the trees as well as on the ground.

Pear Decline in California

CARL W. NICHOLS, HENRY SCHNEIDER, H. J. O'REILLY,
THOMAS A. SHALLA, and W. H. GRIGGS[1]

A serious disorder of pears, resulting in the collapse of an estimated 10,000 trees, made a sudden and widespread appearance in California during the summer of 1959 (1). This disorder resembles pear decline, a devastating disease which has, during the past decade, taken a heavy toll of trees in central Washington (11, 31) and in British Columbia (16, 17, 28, 29). More recently a decline of pear trees has been reported in the Medford area of southern Oregon (31), some of which has been diagnosed as pear decline by anatomical methods (5).

In Washington (11, 31), some trees wilt suddenly (Fig. 1A)—especially during the summer and autumn—while others make little or no terminal growth in the spring and remain in a low state of vigor (Figs. 2B, C, and D). Trees with the wilt symptom were prevalent in California in 1959 (Fig. 1B) (1), while trees with sparse growth were not seen until the spring of 1960.

Since California produces more pears than any other state (420,000 tons in 1959) (3), the potential importance of pear decline to California was recognized several years ago by the California State Department of Agriculture and the University of California. Members of these organizations observed the disease in Washington, made surveys for the disease in California, and began studies of the disease in co-operation with Washington State University and the United States Department of Agriculture.

The purpose of this paper is to: 1) describe the symptoms of the disorder in California and compare them with those observed in Washington; 2) review the literature on pear decline; 3) report the results of the 1958 and 1959 inspections in California for pear decline; and 4) describe experiments in progress in California to determine the cause of the disease and suitable control methods.

Symptoms

Symptoms were first observed at Davis, California, in May of 1959, and by July the disorder was reported from all major pear growing counties except Lake and Mendocino where affected trees were not seen until later in the season. These symptoms were not confined to any one variety and were as follows: the fruit stopped sizing and both fruit and leaves suddenly wilted. The wilting was followed by some scorching and death of the leaves (Fig. 1B). Top symptoms corresponded to those produced where trees were severely girdled by rodents.

In September 1959 a premature and abnormal reddening of foliage became widespread in all counties where trees had wilted earlier (Fig. 1C). A large percentage of the trees (mostly Bartlett) which had red foliage in the fall of 1959 were showing severe symptoms of decline in the spring of 1960. Reddening of pear foliage is often associated with root injury or girdling. What relationship, if any, this abnormal coloration has to pear decline is unknown. It may be due to

Figure 1. A. Bartlett pear trees in Washington showing the "quick decline" stage of pear decline.

B. Affected Bartlett pear tree seen in California in 1959 after most of the leaves had wilted, dried and fallen, leaving many shriveled, unmarketable fruits.

C. Winter Nelis pear tree in California showing abnormal and early red coloration of foliage. Bartlett pear with normal green foliage.

D. Brown pathological phloem tissue adhering to the cambial surface of the xylem at the bud union of a pear decline-affected tree in Washington.

E. Cambial surface of the woody cylinder at the bud union of a healthy Bartlett tree. (Photos B and C by H. K. Wagnon, the rest by G. L. Stout.)

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The authors wish to thank Dr. Earle C. Blodgett, Plant Pathologist for the Wash. State Dept. of Agric. and Wash. State Univ., who has been very generous with his advice and assistance on the pear decline problem during his several trips to California pear orchards and during the trips made by California personnel to observe pear decline in the State of Washington.

FIGURE 1-A

FIGURE 1-B

FIGURE 1-C

FIGURE 1-D

FIGURE 1-E

the girdling effect of the sieve-tube necrosis described below. A reddening of pear foliage that may be associated with pear decline has been reported in Washington (8, 9, 12).

In the spring of 1960, trees were observed in which the new growth was sparse, little or no terminal growth was apparent, and leaves were small with a light green color (symptoms were the same as those shown in Fig. 2B, C, and D). Additional trees were seen with these symptoms as well as with the sudden collapse-type symptoms as the season advanced.

In both the summer of 1959 and the spring of 1960, in many, but by no means all, of the affected trees, a brown line was noted on the cambial face of the bark at the graft or bud union. Occasionally when bark was torn from dry wilted trees, this brown phloem tissue remained attached to the wood and caused a brown line on the face of the woody cylinder (Fig. 1D). In a few cases, vertically fluted ridges were present on the cambial face of the bark at the line of union of the scion and rootstock. Examinations of healthy trees showed no such abnormalities (Fig. 1E). These symptoms have been observed in some of the pear decline-affected trees in Washington (23); however, many trees in advance stages of decline or collapse did not have the brown line symptoms.

Histological studies have been made of the bud or graft unions of healthy and decline trees in the Pacific Northwest (5, 23, 24)[2] and in California. Microscopic symptoms were similar to those of buckskin virus-infected cherry trees on Mahaleb rootstock (21) and tristeza virus-infected sweet orange trees on sour orange rootstock (22). The first pathological change seen in affected pear tissue was the abnormal accumulation of a substance called "callose" on the sieve areas of the sieve tubes in the phloem just below the bud or graft union. The sieve tubes are located on the inner surface of the bark and conduct carbohydrates, photosynthesized in the leaves, to the roots. This primary symptom was observed frequently in Oriental rootstock and occasionally in French rootstock. The callose accumulation was followed by lysis of the cell contents. New abnormal phloem cells were produced in trees on Oriental rootstocks but rarely in trees on French rootstocks. In severely affected trees the new cells were killed almost as fast as they were produced, being crushed by the enlargement of ray cells. The presence of this abnormal phloem in annual phloem rings was indicative of the number of years the trees had been affected.

In California, examinations of the roots of affected trees in both the summer and fall of 1959 and the spring of 1960 (at the time of writing) revealed that many roots of one-eighth inch diameter or smaller were dead. Tests showed that the roots (and also branches) of the affected trees, when compared with those of normal trees, had relatively small amounts of stored food.

In Washington, affected trees have been placed in two categories, "quick decline" or trees that wilt suddenly (Fig. 1A), and "slow decline" or trees in which terminal growth of shoots is stunted and sparse (Figs. 2B, C and D) (11, 31). Slow decline trees are arbitrarily rated on a numerical 1 to 5 basis according to severity of decline symptoms. These ratings are: *1)* normal-appearing trees (Fig. 2A) *2)* terminal growth somewhat limited (Fig. 2B), *3)* terminal growth definitely limited, *4)* no terminal growth (Fig. 2C), and *5)* no terminal growth, very sparse foliage, some trees nearly dead (Fig. 2D) (26, 31).

Review of Literature

McLarty (17) described a killing of trees in British Columbia in 1948. Several pear varieties were affected and no cause was found. Later, Woodbridge in British Columbia (28, 29) reported the occurrence of a disease called "summer wilt" which affected many pear varieties in several districts. Degman (12) expressed the belief that this disorder, known now as pear decline, was due to an unbalanced condition between tops and roots or faulty conducting tissues between the tops and roots. He pointed out that many trees declined from the severe winters of 1948-1949 and 1949-1950. Other trees were said to be affected by faulty irrigation. He did not indicate whether winter injury and faulty irrigation could account for all of the declining trees.

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[2] This work was undertaken in the Pacific Northwest as a result of an invitation from Dr. Earle C. Blodgett, and in 1957 bark collections were made with his co-operation and guidance. The collections were mostly from declining trees on *Pyrus serotina* Rehd. rootstocks, and the work was partially financed by Washington State University. In 1958 and 1959, the work was continued and was partially supported by the U.S.D.A. During these years Dr. L. P. Batjer and other personnel of the U.S.D.A. and of Wash. State Univ. co-operated in the collection work.

Blodgett *et al.* (11), in Washington, stated that quick decline probably first occurred in Washington in 1948, but mostly since 1950. They observed no correlation between soil type and decline and that orchards on Japanese (Oriental) rootstocks were more prone to slow decline than were those on French rootstocks. Unaffected trees were found in orchards where decline was present, and, in the same orchards, some rows of trees were affected while adjacent rows were not. Merrill (18, 19, 20) reported that the disease occurred primarily in mature trees but that in some cases trees younger than six years were affected and that two-year-old trees had developed quick decline symptoms. Since pear plantings in recent years primarily have been on Bartlett seedling rootstocks, a combination rarely affected by pear decline (5), it is possible that these younger trees declined from causes other than that producing typical pear decline. However, Blodgett and Aichele (9) have shown that pears on Oriental rootstocks can develop "quick decline" symptoms the second year in the orchard.

Woodbridge (30) stated that pruning did not cause trees to recover; and two years work indicated that pear decline was not caused by faulty nutrition. He reported that in 50 orchards surveyed in 1956 and 1957 there was no increase in the amount of pear decline. Both quick decline and slow decline occurred in trees on French rootstock planted prior to the first world war, but the incidence was much less than for trees on *Pyrus serotina* Rehd. (*P. pyrifolia* (Burm.) Nakai) rootstocks. Woodbridge *et al.* (31) reiterated that most of the decline was in trees on *P. serotina* rootstocks planted between 1922 and 1935.

Sprague (25, 26) reported on fungi isolated from roots of affected pear trees. He was the first to observe the scarcity of small feeder roots on the weaker trees and isolated several fungi which were suspected as a possible cause of the disease. McIntosh (16) frequently isolated a fungus (*Phytophthora cactorum* (Leb. and Cohn) Schroet.) from soil in orchards with decline in British Columbia. When roots of Bartlett pear seedlings were exposed to this fungus, feeder roots became infected and growth in the tops was greatly reduced. He re-emphasized the possibility that this and other closely related fungi may be implicated in the development of pear decline. However, Batjer and Schneider (5) report that trees on Bartlett seedling rootstocks were rarely affected by pear decline.

Batjer (4), Blodgett (6, 7), and Merrill (18, 19, 20) reviewed the work being done in Washington to determine the cause of the pear decline disorder. In a later progress report, Blodgett and Aichele (9) reported that the cause of the disease was still unknown. However, their experiments indicated that the disease was not caused by: (a) nutritional deficiencies nor excess fertilizer, (b) unusual cultural conditions, (c) low-temperature injury, or (d) excess irrigation. They suggested that there was a possibility that a transmissible factor (virus) might be involved even though trees propagated from both diseased and healthy trees declined. They also reported that plant parasitic nematodes were present and that they or other microorganisms might be involved. The possible relation of viruses to pear decline was discussed by Kienholz (15).

Stout and Altstatt (27) reported that during statewide inspections of California pear orchards in 1958 no pear trees were diagnosed as positive for pear decline. However, in 1959 (1) many pear trees were found to be collapsing and dying in California. Blodgett (8) reported that in all comparable respects there was no apparent difference between California pear "collapse" and Washington "quick decline."

Batjer and Schneider (5) presented evidence that a sieve-tube necrosis below the bud union was associated with pear decline; they showed that this necrosis was of value in diagnosing pear decline. They also showed that starch accumulated above the bud union and was deficient in the roots in pear decline-affected trees having sieve-tube necrosis, indicating an interference in the translocation of carbohydrates from the tops to the roots. In the orchards examined, they found that most trees on Oriental rootstocks (*P. ussuriensis* Maxim, *P. serotina*, and *P. calleryana* Decne.) were very severely affected by decline and sieve-tube necrosis while less than half of the trees on French rootstock were affected and they usually only mildly so. Trees on Bartlett seedling rootstock were rarely affected. Trees which became scion-rooted were free of the disease, as were also trees on *P. betulaefolia* Bunge rootstocks. Anatomical evidence was presented for the appearance of pear decline in Oregon about 1956, in California in 1958 and in Washington before 1952.

A decline of pear trees on quince rootstock that may or may not be related to

FIGURE 2-A

FIGURE 2-B

FIGURE 2-C

FIGURE 2-D

the North American disorder has been reported in Israel (13).

Surveys in California

During the summer of 1958, the Bureau of Plant Pathology of the California State Department of Agriculture in co-operation with California county agricultural commissioners conducted a statewide survey of pear orchards to determine if the pear decline disorder was present (27). A total of 196 properties representing 6,293 acres in 21 counties (Contra Costa, El Dorado, Glenn, Kern, Lake, Los Angeles, Mendocino, Napa, Nevada, Placer, Sacramento, San Benito, San Joaquin, San Luis Obispo, Santa Clara, Santa Cruz, Solano, Sonoma, Sutter, Yolo, and Yuba) was inspected. Although a few declining trees were seen, none was diagnosed as pear decline. Phloem samples were taken from the graft or bud unions of some of the declining trees and, although slight histological abnormalities were present in a few of the samples, these abnormalities were not typical of those found in the pear decline-affected trees in the Pacific Northwest.

In 1959, surveys were again conducted by the Bureau of Plant Pathology, in co-operation with the California county agricultural commissioners, and also by the farm advisors in the counties concerned. Trees with pear decline symptoms were seen in 16 California counties. Based on these surveys, it is estimated that in California in 1959, 10,000 pear trees developed symptoms identical to the "quick decline" stage of the disorder. The greatest numbers of affected trees were found in Placer, Sacramento, El Dorado, and Solano Counties. Smaller but significant numbers of affected trees were found in Santa Clara, Glenn, Contra Costa, Yuba, Yolo, and Sutter Counties. Scattered affected trees were found in Lake, Mendocino, Napa, Nevada, San Benito, and Sonoma Counties. No affected trees were found in Santa Cruz, Los Angeles, and San Diego Counties. A microscopic examination of phloem tissue taken from the bud or graft unions of 20 of these affected trees showed injury indistinguishable from that occurring in pear decline-affected trees in the State of Washington.

To further evaluate this disorder, inspections of California pear orchards are being conducted in 1960 and surveys up to the time of writing, have revealed many trees with symptoms identical to the "slow decline" and "quick decline" trees seen in Washington.

Pear Decline Research

Studies relating to the nature and cause of pear decline and development of suitable control methods have been initiated by the Departments of Plant Pathology and Pomology, University of California and the United States Department of Agriculture at Riverside. From previous studies on pear decline in the Pacific Northwest (5, 9, 16) viruses and soil fungi have been implicated as possible causal agents. That viruses may be involved is further suggested by the type of damage observed at the bud union of affected trees (5, 21, 22, 23). Research efforts in California are being directed primarily to determine if either of these agents cause pear decline.

Virus transmission tests and tests to determine susceptible scion-rootstock combinations, are being established in plots at Davis, Riverside, San Jose and the farms of the DiGiorgio Fruit Corporation.[3] Extensive isolations of fungi from the roots of decline-affected trees are being made from several districts in the State. These fungi will be studied to determine what, if any, role they have in disease development.

Other factors such as soil, soil moisture, climate, nutrition, cultural practices and the interrelations between rootstock, intermediate stock, and scion are being investigated in relation to development of pear decline. Physiological and biochemical studies of stock and scion tissues also are being made.

The possible relationship between soil temperatures and pear decline is being studied by growing young pear trees under controlled conditions in the greenhouse.

Observations in Washington and Oregon have indicated that Bartlett trees which have developed roots above the graft union as

Figure 2. One normal and three pear decline-affected Bartlett pear trees in Washington.

A. Normal tree (Stage 1, see text).

B. Affected tree showing a slight limitation of terminal growth (Stage 2).

C. Affected tree showing essentially no terminal growth (Stage 4).

D. Affected tree showing no terminal growth and very sparse foliage (Stage 5). (Photos by G. L. Stout.)

[3] Virus transmission work at the DiGiorgio farms is being done in co-operation with Dr. Luigi Chiarappa, Plant Pathologist for DiGiorgio Fruit Corporation.

well as those growing on Old Home body stocks which have developed roots above the Old-Home-seedling rootstock graft union have not exhibited decline symptoms (2). With this in mind studies started in 1957 (14) to develop practical methods for propagating own-rooted Old Home, Farmingdale, and Variolosa pear varieties from hardwood cuttings have been expanded to include the Bartlett variety. A successful method of propagating Old Home trees on their own roots has resulted and university personnel will co-operate with nurserymen in developing such trees for commercial planting. Deep planting of Bartlett propagated on quince rootstocks apparently has produced scion-rooted trees in Washington (10).

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Biological Control of Scotch Broom

By LOWELL MOBLEY, *Agricultural Commissioner*, El Dorado County

The first attempt at biological control of scotch broom *(Cytisus scoparius)* in the United States was initiated with the release of 1,000 twig borer moths *(Leucoptera spartifolicella)* June 7 by James K. Holloway, Chief of Parasite Introduction and Investigation, U.S.D.A. and University of California; Frank Skinner, University of California; and Lowell Mobley, El Dorado County Agricultural Commissioner.

Agricultural Commissioner Lowell Mobley revealed that the moth had been released in a select location near Georgetown, El Dorado County. After having been flown from Paris, France (200 as adults and 800 as pupae), to New Jersey, where they were checked through quarantine to prevent the introduction of any unwanted pests, they were airmailed to Mr. Holloway in Albany, California, and were delivered by him to Placerville.

The adult moth is a beautiful silver-gray insect about one-fourth inch in length. The larvae feed in the tended growing tips, stunting the plant and reducing seed production. Reports indicate that in France, as a result of the insect activity, scotch broom occurs as a scattered dwarf shrub, and is not considered a pest.

Release of the moth brings to fruition a program which was first recommended in 1921 by Professor Harry Smith of the Uni-

Twig borer moth *(Leucoptera spartifolicella)*. Enlarged 13.6x.

3—27200

versity of California Citrus Experiment Station. In 1934 Dr. Smith again surveyed the broom and made an unsuccessful attempt to organize a biological control program. Twenty years later (in 1954) the El Dorado County Board of Supervisors ordered a survey made by the agricultural commissioner of the scotch broom situation. When over 27,000 acres were found to be infested, and switch broom was becoming a major pest of forest and range lands, it was realized that biological control was the only feasible approach to the problem. Letters and resolutions were sent to Dr. Paul F. Sharp, Director, College of Agriculture, University of California, Dr. Paul Oman, Chief, Insect Identification and Parasite Introduction Research Brand, U.S.D.A., Senator Clair Engle, then Second District Congressman, and James Holloway, as well as the U.S. Forest Service, State Division of Forestry and other interested persons and organizations requesting their aid.

Their fullest co-operation was received thus insuring the success of the program. Considerable resistance had to be overcome in other states before clearance could be secured for the introduction of the moth. Extensive testing and research was necessary to insure that the insect would feed only on brooms and not become a menace to agriculture. It was discovered that the moth found crinkled stems, like scotch broom, attractive over smooth stemmed plants. When under population pressure the moth will oviposit on smooth stemmed legumes. The larvae soon die after hatching.

It will now be a matter of waiting to see how successful the twig borer will be in controlling the estimated 100,000 acres of scotch broom in California. In the meantime, research will be continued seeking another insect that can be used in case the moth is not entirely successful.

It is with deep regret that we announce the death of Lowell D. Mobley, El Dorado County Agricultural Commissioner and Sealer of Weights and Measures, which occurred September 21 in Placerville.

Commissioner Mobley was an efficient public officer and thoroughly dedicated to protecting and servicing the agricultural industry of his county. Prior to his death he was active in investigating the pear decline disease which has caused so much damage to orchards in his area, and in other pear growing sections of the State.

The Department of Agriculture has lost an excellent co-operator and one who has been of great assistance in many state and county agricultural problems.

Mr. Mobley was born in Denair, California, November 7, 1906. He was educated in San Bernardino Elementary and High School and attended the University of Oregon.

Semipermanent Anticoagulant Baits

By REX E. MARSH [1] and LLOYD F. PLESSE [2]

Anticoagulant rodenticides developed in recent years have become widely accepted and extensively used in rat and mouse control. Relatively slow in action, anticoagulants require multiple feedings to bring about death by depleting the coagulating factors of the blood, thus causing internal hemorrhaging. The anticoagulants obviously have a safety margin not available in other materials.

The Need for Semipermanent Baits

In areas of high humidity and excessive moisture, treated grain baits often become damp, caked or moldy rendering them unacceptable to rodents. Due to this condition there exists a need for a formulation which will remain effective for long periods under adverse conditions. Incorporating anticoagulant treated grain bait in melted paraffin appears to be a solution to this problem. Coating of such baits with substances to make them impervious to moisture, though not a new concept in rodent control, has not been extensively applied to the anticoagulants in California.

Three years ago at the suggestion of Lloyd Plesse, Deputy Agricultural Commissioner of Santa Clara County, paraffin coated baits were prepared for use in the control of Norway rats in sewers, where dampness is a major problem. Preliminary trials in the City of Santa Clara resulted in satisfactory control with these coated baits. Additional trials were later conducted which also gave satisfactory acceptance and control. Based on these results the Cities of Santa Clara, Los Gatos and Sunnyvale are now using paraffin coated anticoagulant baits to control rats within their sewer systems.

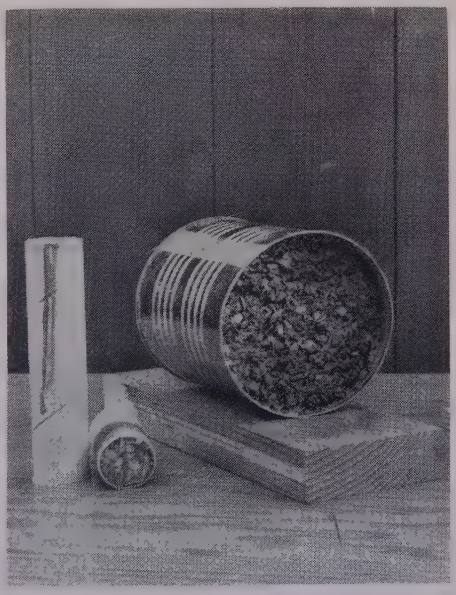
Bait Preparation

Anticoagulant treated bait materials are prepared by the standard mixing procedure, using any grain which has been predetermined to be acceptable to the rodents. Blocks of paraffin are melted in a double boiler type of container using a water bath. The treated material is then stirred into the melted paraffin in sufficient quantity to provide a thick but flowable mixture. The paraffin bait is then poured into containers and allowed to cool and solidify. Waxed milk cartons and one-gallon cans, both with tops removed, have proven satisfactory. Various sizes can be used according to the particular need or availability.

The ratio of grain bait varies from one to 1½ pounds to one pound of paraffin, according to the type of grain used.

Rat Control in Sewers

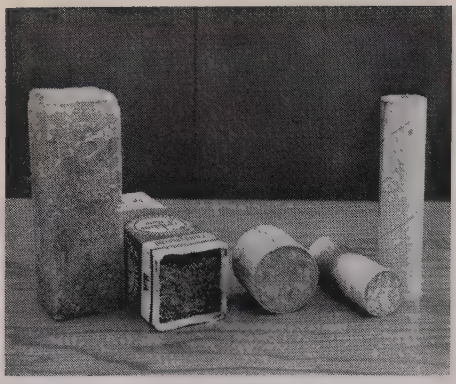
For rat control in sewers, one-gallon cans of anticoagulant paraffin bait are placed on their sides and toe nailed to a length of board. A wire is attached to the bait container which is then placed on the apron of



LEFT: Cardboard cores containing paraffin embedded warfarin treated rolled barley. RIGHT: One gallon paraffin bait station as used for sewer rat control.

[1] Rodent and Weed Control Assistant, Bureau of Rodent and Weed Control and Seed Inspection.

[2] Deputy Agricultural Commissioner Santa Clara County Department of Agriculture.



LEFT: Two blocks are the results of using empty milk cartons for bait molds. RIGHT: Three were molded in cardboard tubes, the smaller of which is suitable for gopher control.

Two-pound block of paraffin and warfarin treated rolled wheat is left exposed permanently in building where rat reinfestation is likely to occur.

Paraffin embedded baits being placed in gopher runways in a school playing field.

the manhole. The other end of the wire is then secured to a top ladder rung or other convenient anchor point. This permits easy placement, inspection and removal and also prevents the container from becoming lodged in the sewer lines.

Controlling Other Rodents

Meadow mouse, *Microtus*, damage to young orchard trees with permanent cover crop was reduced using anticoagulant paraffin bait blocks. Blocks, weighing up to one-half pound, were placed at the base of the trees. In all cases, baits were well accepted and withstood varying moisture conditions involving both sprinkler irrigation and rainfall. The blocks used in the meadow mouse test contained either oat groats or rolled barley and were molded in paper cups and empty fruit cans.

House mice, *Mus musculus*, readily accepted paraffin baits containing a mixture of oat grits and canary grass seed. Baits of walnut meats, however, were more readily accepted. Ten-ounce paper cups provide satisfactory molds and hold a quantity sufficient to control a light to medium infestation of mice in a garage or basement.

Satisfactory control was obtained in tests on pocket gophers of the genus *Thomomys*, where they accepted anticoagulant rolled barley-paraffin baits in sufficient amounts. The paraffin provided adequate moisture protection. Moulds consisted of paper cups and paper towel tubes. A volume of three-fourths to one cup of bait provided the necessary amount for multiple feedings. Baits were placed in the main runways which were located with the conventional gopher probe.

Although this type of bait does not appear to be practical for general field work due to the cost, it appears desirable in the home, yard or on school premises where safe material is needed. Efficiency of anticoagulant baits may be greatly influenced by the vitamin K content of the gopher's diet.

Currently, paraffin anticoagulant mixtures are being sold by the Humboldt County Department of Agriculture for the control of wood rats, *Neotoma* spp. The advantages are two-fold: first, a more lasting bait is provided and, second, the bait cannot be readily removed by the rats. Anticoagulant paraffin bait blocks are proving helpful in controlling wood rats in mountain homes and cabins.

Experimental work is being continued and it is hoped that more uses will be found for the new anticoagulant paraffin bait block.

Conclusions

The incorporation of anticoagulant grain baits into melted paraffin making them semi-permanent, has solved the problem of bait spoilage through moulding in areas of high humidity or excessive moisture. Several health departments are effectively using this material for control of rats in sewers.

Results of trials of anticoagulant paraffin bait blocks demonstrate satisfactory control of Norway and black rats, meadow mice, house mice, gophers and wood rats under conditions of excessive moisture.

Entomology and Pathology

Editor's Note:

The reports listed in this section are reprints of mimeographed announcements released by the Bureaus of Entomology and Plant Pathology during the reporting period covered by this issue of the *Quarterly Bulletin.*

The reports contain a brief summary of new or unusual discoveries of plant diseases and insect infestations. They are reported herewith in order to officially record important basic data such as time and location of the discovery as well as a brief account of the circumstances surrounding the situation.

For further information, such as subsequent spread of the infestation or disease, control recommendations, current status of the problem, etc., the reader should write directly to the bureau concerned.

BUREAU OF ENTOMOLOGY

New Insect Species in California

1. *Stilpnotia salicis* (L.), Satin Moth

Association: Electric Light

Order: Lepidoptera

Family: Lymantriidae

Location: Alturas Inspection Station, Modoc County, California

Date: Probably week of July 11, 1960

Collector: F. J. Charrier, Inspector in charge, Alturas Plant Quarantine Station

Degree and Nature of Infestation: One adult male found at light at quarantine station

Description: The adult moth has a wingspread of 1½ to 2 inches and appears to be clear white with a satin lustre. The head, thorax, and abdomen are actually black but are so densely clothed with long satiny white hairs as to appear white. The full grown larva is 1¾ to 2 inches long, the head is black with a bluish tinge and sparsely clothed with short hairs, the body blackish on the dorsum with a broken row of large white blotches down the middle and a narrow broken white subdorsal line on each side. The sides of the body are mottled with black and white, and each segment has a transverse row of reddish-brown tubercles bearing yellowish-brown hairs. The pupa is about 1 inch long, shining black, and is clothed with golden and whitish hairs. The cocoon may be spun in leaves, on the twigs, or on other objects, and consists of a loosely woven structure of silk.

Identified by: W. R. Bauer, Systematic Entomologist, Bureau of Entomology, Sacramento.

History:

Previous known range: Europe and Asia, in North America in the New England states, maritime provinces of Canada, British Columbia, Washington and Oregon.

Other Recorded Hosts: This moth is attracted to members of the family Salicaceae, which includes aspen, cottonwood, poplar, and willow. Shade and ornamental poplars and willows are reportedly most severely attacked.

Potential Economic Importance, Recommendations and Life History:

A preliminary survey of the area around the quarantine station at Alturas places this insect in Alturas, Canby, Davis Creek, Likely, New Pine Creek and Perez in Modoc County, and at Tulelake in Siskiyou County. The results of further investigations will be reported in extension form.

The satin moth was found at New Westminster, British Columbia, in 1920. It has spread down through Washington and Oregon west of the Cascade Range as far south as Coos County, Oregon. Its appearance east of the Cascades is rare, the California records here reported, and infestations around Grass Valley, Sherman County, Oregon, being the only ones available to date. It is likely that other records will be forthcoming and an infestation pattern established.

This moth is strongly attracted to light in early evening and is very easy to take since it does not attempt to escape capture.

It was discovered that the female moths taken in the preliminary survey had already laid their eggs. Eggs are deposited around the middle of July. They are laid on leaves, branches or trunks of trees or on other surfaces in masses ranging from 100 to 400 each, although one female may deposit as many as 1,000 eggs. The masses, roughly oval in shape and about ⅝ inch long, are covered with a glistening white secretion.

Hatching takes place in around 15 days or early in August. The larvae feed on various species of aspen, cottonwood, poplar or willow and in this early instar feed only upon the epidermis of the leaves. After feeding for five or six days, the first instar encloses itself within a small silken web, where it molts. The second instar feeds for five or six days, migrates to a branch or trunk of the tree, sometimes making an excavation by chewing the bark, and spins a cocoon-like hibernaculum in which it spends the winter. Occasionally a few larvae continue their activity until late fall. The larvae emerge from hibernation during the latter part of April or early in May and usually attain full growth in June. Beginning with the fourth instar the larvae devour the entire leaf substance instead of skeletonizing it. Both sexes pass through seven larval instars before pupation, and about 9 or 10 days are spent in the cocoon before emergence.

There are reportedly two generations annually of the satin moth in portions of Europe and Japan. How it will react in

this new environment is questionable and the life history here reported may be open to change.

A parasite, *Apanteles solitarius*, is generally credited with the population decrease of the satin moth in Washington. The presence or absence of this braconid in California is of great importance, and attempts will be made to determine if this parasite or other parasites might be present.

This moth has been rated a "B" pest.

2. *Oligonychus aceris* (Shimer), Silver maple mite

Host: *Acer* spp., principally silver maple, *Acer saccharinum*

Order: Acarina

Family: Tetranychidae

Location: Arlington, Riverside County, California

Date: August 4, 1959

Collector: Norman W. Getz, Agricultural Inspector

Degree and Nature of Infestation: Heavy infestation of adults on leaves.

Description: This round somewhat globular mite is about ½ mm. long and dark green in color. It has raised dorsal tubercles and may be separated from similar species by its extra long empodial claws.

Identified by: Hartford H. Keifer, Systematic Entomologist, California State Department of Agriculture.

History:

Previous known range: Generally throughout the eastern United States and Yakima, Washington.

Native Habitat: Illinois.

Other Recorded Hosts: None.

Potential Economic Importance and Recommendations:

This mite inhabits the underside of maple leaves and causes considerable discoloration. Although attack by the mite is probably not fatal, the tree is appreciably weakened and subject to pests seldom associated with a healthy tree. The mite probably overwinters as eggs on the limbs of its host. Other counties where the mite is found include Orange, San Bernardino, Los Angeles, and El Dorado.

3. *Myzus Hemerocallis* Takahashi, Daylily aphid

Host: *Hemerocallis* sp., (Daylily)

Order: Homoptera

Family: Aphidae

Location: Arcadia, Los Angeles County, California

Date: 8-III-1959

Collector: W. Quinn Buck, Los Angeles County Arboretum.

Degree and Nature of Infestation: Heavy infestation of adults and nymphs on host.

Description: The day lily aphid resembles the green peach aphid, *Myzus persicae*, in size and shape; however, it has no black abdominal patch. Its color is much like that of the foxglove aphid, *Myzus solani*, except that the leg markings are diffused. The cornicles are cylindrical and are slightly swollen on the inside near the terminal flange. There are three brown marks on the pronotum; a patch on either side of a smaller median mark. There are few sensoria on the third antennal segment.

Identified by: Dr. R. C. Dickson, Associate Entomologist, Citrus Experiment Station, University of California, Riverside, California.

History:

Previous known range: China, Japan and the State of Louisiana.

Native Habitat: China or Japan

Other Recorded Hosts: None

Potential Economic Importance and Recommendations:

Dr. R. C. Dickson, aphid specialist at the Riverside Experiment Station, states: "Apparently this species can be quite a pest but I do not know any published report on it. Probably it has a parasite in the Orient. It belongs to an Oriental group related to *Neotoxoptera* (aphids found here on onion, violet, pinks, etc.) which seem to have arrived without their parasites. Probably it is not a pest in its native habitat, thus explaining the lack of literature on it." This aphid has also been found in Riverside County.

4. *Aceria celtis* Kendell (Hackberry gall mite)

Host: *Celtis* sp. (Hackberry)

Order: Acarina

Family: Friophyidae

Location: Monterey Overpass, Fresno, Fresno County, California

Date: March 30, 1960

Collector: J. W. Dixon, Agricultural Commissioner, Fresno County

Degree and Nature of Infestation: Heavy population of adults in buds.

Description: A small yellowish-white wormlike mite about 1/200 of an inch long. Visible with a 10X hand lens when alive. Distinguished by the 5-rayed featherclaw, unmarked shield and large rounded tubercles on body.

Identified by: H. H. Keifer, Systematic Entomologist, California State Department of Agriculture.

History:

Previous known range: Eastern United States on hackberry, *Celtis occidentalis*

Native Habitat: Boston, Massachusetts

Other Recorded Hosts: None

Potential Economic Importance and Recommendations:

This mite causes deformation and stunting by producing large bud clusters or witches brooms, on its host. The host may be considerably weakened and its value as a shade tree seriously impaired.

5. *Aceria* **n. sp.**

Host: *Cynodon dactylon* (Bermuda grass)

Order: Acarina

Family: Eriophyidae

Location: Brawley, Imperial County, California

Date: 20-IV-1960

Collector: V. Roth, Farm Advisor, Imperial County

Degree and Nature of Infestation: Heavy infestation on host.

Description: This Eriophyid is a wormlike, nondescript, yellowish-white colored mite 1/200" in length. It can be readily seen with a 10X hand lens. Under high power it discloses microtubercles on the abdomen which are acute but not pointed. Its featherclaws are six-rayed. This mite can be distinguished from another Eriophyid (*Eceria cynodonis* Wilson) which attacks Bermuda grass along the Southern California coast by a remarkable difference in the cephalothoracic shield. *A. cynodonis* has this shield notably produced forward while the new species here reported exhibits a normal shield.

Identified by: H. H. Keifer, Systematic Entomologist, California State Department of Agriculture.

History:
Previous known locality: Phoenix, Arizona
Native Habitat: Lower Colorado River area
Other Recorded Hosts: None
Potential Economic Importance and Recommendations:
This mite causes severe stunting of the grass and even may kill its host. Extensive damage by such a small arthropod is remarkable and is accomplished by enzymatic action. These enzymes, produced by the salivary glands, are introduced into host cells by tiny mouthparts. This Eriophyid lives in the terminal buds and leaf folds.

6. *Lecanium kunoensis* **Kuwana, (Kuno scale)**

Host: *Pyracantha* sp.

Order: Homoptera

Family: Coccidae

Extension Infested Area of Pest Previously Reported. Found: Chico, Butte County. Date: April 11, 1960. By: R. Mackessy, Agricultural Inspector

Degree and Nature of Infestation: A heavy infestation of live adults was found on twigs of the host.

Remarks: This scale was found originally in in 1894 in Alameda County and has confined its activity to the immediate Bay region since that time. This infestation indicates a remarkable climatic transition for this scale in California.

BUREAU OF PLANT PATHOLOGY

Report of New or Unusual Plant Pathogen

1. *Type of Pathogen:* **Fungus**

Host: Andorra Juniper, *Juniperous horizontalis* Moench var. *Plumosa* Rehd

Scientific Name of Causal Pathogen: *Gymnosporangium juniperi-virginianae* Schw.

Common Names of Disease: Cedar-apple rust and cedar rust.

Case History:
Location: Santa Rosa, Sonoma County.
Date: April 14 and April 21, 1960.
Type of planting: 2 nurseries.
Collector: W. R. Michie, Sonoma County Department of Agriculture, and E. P. Delfino, Sonoma County Department of Agriculture.
Identified by: C. G. Weigle, California Department of Agriculture; confirmed by G. B. Cummins, Purdue University.

Nature and Degree of Infestation: Found on two Andorra junipers, both in one-gallon cans—one in a nursery lot of 50 plants, and the other in a 2,000-plant lot.

Description of Disease: On cedar: Deep-brick-red to chocolate-brown galls, varying in size from that of a grain of wheat to 2 inches in diameter. Surface at first smooth, later shows series of circular depressions with central dimple-like protuberances.

On apple: On leaves, starts in May as small, pale yellow spots on upper surface which later turn orange. Spots extend through leaf and in July or August protuberances appear on under surface which develop into open, cylindrical tubes, the ends of which split into segments and curl back on themselves. Leaves are dwarfed and often fall from tree.

Occurs also on current season's twigs and fruit.

General Information and Previous History:
Known Distribution:
California: Occasionally intercepted at border stations on apple leaves. Intercepted in Sonoma County on red cedar liners, *Juniperus virginiana* L. var. *Burkii* Bailey, originating in Missouri, on February 16 and February 26, 1960, by C. H. Anderson, Sonoma County, Department of Agriculture.
Other states: Maine to North Dakota and from southern Canada to Florida and Texas. Reported from Alaska.
Elsewhere: Not known to occur in other countries.

Type of Habitat: Occurs on apples and cedars when in close proximity under conditions of cool summers and spring rains or misty fogs.

Known Host Range: The aecial stage occurs only on crab apple and the cultivated apple in which there is considerable difference in varietal susceptibility. The telial stage occurs on *Juniperus virginiana, J. scrophulorum,* and *J. horizontalis.* All other junipers seem to be immune.

Alternate host required; cannot spread from apple to apple, nor from juniper to juniper. No susceptible native junipers occur in California's major commercial apple growing area.

Importance and Recommendations: This disease is not known to be established in California and is therefore classified an "A" pest. It causes serious loss in the east on apples grown near infected junipers (within 4-5 miles). We believe climatic factors could be favorable for establishment of the disease in the State's major coastal apple areas, but not in the drier inland areas, in the presence of substantial plantings of susceptible junipers.

Shipments of ornamental junipers from infested areas should be carefully inspected for presence of rust galls and infected shipments rejected. Special attention should be given to shipments originating in Missouri since all infected plants found so far have originated in that state.

2. *Type of Pathogen:* **Fungus**

Host: White birch, *Betula* sp.

Scientific Name of Causal Pathogen: *Melampsoridium betulinum* (Pers.) Kleb.

Common Name of Disease: Leaf rust.

Case History:
Location: Santa Rosa Sonoma County.
Date: May 17, 1960.
Type of Planting: Nursery.
Collector: W. R. Michie, Sonoma County, Department of Agriculture
Identified by: C. G. Weigle and T. G. Scandone, California Department of Agriculture; confirmed by G. B. Cummins, Purdue University.

Nature and Degree of Infestation: Found on under surface of many leaves on 2,000 liners originating in Oregon; spreading into other stock that was locally produced and is growing in the same nursery where the liners were planted.

Description of Disease: Attacks leaves of seedlings and mature trees. Causes spots on under surfaces of leaves and also falling of the leaves. Spots are bright reddish-yellow, turning dark brown to nearly black in later summer. Spores from these spots carry the infection from leaf to leaf of birch, or to larch, an alternate host. The alternate stage causes a blister-rust on larch. In mixed plantings both hosts may be seriously injured. The rust overwinters in birch leaves.

General Information and Previous History:
Known Distribution:
California: One previous find in a San Francisco retail nursery in 1941.
Other states: Newfoundland to Wisconsin southward to New Jersey and Indiana in eastern section, southeastern Alaska, southward to western Montana and Washington in western section.
Elsewhere: Europe, Siberia, Japan, and New Zealand.

Known Host Range:
(Betula glandulosa), bog birch or scrub birch; *(B. kanaica)*, red birch; *(B. jutea)*, yellow birch; *(B. occidentalis)*, western paper birch; *(B. papyrifera)*, paper birch; *(B. populifolia)*, gray birch; *(B. pumila)*, swamp birch; *(B. pendula)*, split leaf birch.

The fungus has stages of its life cycle on eastern larch, *Larix laricina*.

Importance and Recommendations: The fungus is not known to be established in California on planted trees. In other states it causes severe leaf spotting and defoliation on various birch varieties. Control is difficult.

It is suggested that birch, imported from infected states, be segregated from other birches through first growing season and observed for evidence of leaf rust. Infected trees should be destroyed, regrafted with noninfected scion wood or defoliated. Defoliated trees should be sprayed with Fermate at 10- to 14-day intervals until the new foliage is fully developed.

3. *Type of Pathogen:* **Fungus**

Host: Apricot, *Prunus armeniaca* L.

Scientific Name of Causal Pathogen: *Cytosporina* sp. (probably the imperfect stage of *Eutypa armeniacae* Hansf. & Carter).

Common Name of Disease: Apricot gummosis or dieback.

Case History:
Location: Alameda County near Centerville.
Date: May 26, 1959.
Type of planting: Orchard.
Location: Santa Clara County near San Jose.
Date: May 26, 1959.
Type of planting: Orchard.
Collector: W. H. English, J. E. DeVay, L. B. McNelly, University of California.
Identified by: W. H. English and J. R. Davis, University of California.

Nature and Degree of Infestation: Slight to severe in different orchards.

Description of Disease (including identifying characteristics): Death of various sized branches with copious gum formation on bark and dark brown discoloration of xylem.

General Information and Previous History:
Known Distribution:
California and other states: Not reported previously in the United States.
Elsewhere: Australia and Tasmania.

Type of Habitat: Most severe in high rainfall areas.

Known Host Range: Apricot and prune in Australia; to date found only on apricot in California.

Importance and Recommendations: This disease probably has been responsible for heavy losses in Santa Clara and Alameda Counties for many years without the cause being known. Research is necessary before positive control recommendations can be made. This research is being done at the University of California, Davis.

4. *Type of Pathogen:* **Virus**

Host: Peach (*prunus persica* (L.) Batsch)

Name of Casual Pathogen: Peach Yellow Bud Mosaic Virus.

Common Name of Disease: Peach Yellow Bud Mosaic.

Case History:
Location: Beaumont, Riverside County.
Date: May 18, 1960.

Type of planting: Commercial (fruit).
Collector: H. Pierce, U.S.D.A.
Identified by: R. L. McClain and J. P. Hill, California Department of Agriculture.

Nature and Degree of Infestation: Eighteen peach trees in one small planting.

Description of Disease: The growth of the leaf buds in the spring is arrested or severely retarded producing very short tufts of tiny, pale-yellow leaves. These tufts may die, remain in an arrested state of growth, or develop into small rosettes of dwarfed, distorted, yellowish-green leaves. Larger leaves may be distorted with a yellow, irregular, blotchy mottle. Dieback of twigs and younger branches may occur while older branches and limbs become sunburned due to a lack of foliage. Infected trees decline and become unprofitable. (For illustrations see California Department of Agriculture Bulletin 41(2): 53-57, 1952; Plant Disease Handbook for Agricultural Inspectors; and U.S.D.A. Agricultural Handbook #10).

General Information and Previous History:

Known Distribution:
California: Butte, El Dorado, Napa, Nevada, Placer, San Bernardino, Solano, Sutter, Tehama, Yolo, Yuba, and possibly Santa Cruz Counties (see below).
Other states and elsewhere: Not reported outside of California.

Type of Habitat: No specific habitat limitations are known.

Known Host Range: Almond *(Prunus amygdalus)*, Apricot *(P. armeniaca)*, and Japanese plums *(P. salicina)*. When inoculated with a virus from Himalaya blackberry *(Rubus procerus)* from central coastal California, peach trees developed symptoms similar to those described above. The peach yellow bud mosaic virus has been inoculated into, and produced symptoms on, many herbaceous plants in the greenhouse, but has not been found in these plants in the field. Other stonefruits also have been experimentally infected with this virus but have not been found to be infected in the field.

Importance and Recommendations: Yellow bud mosaic of peach is a destructive virus disease of limited distribution in California. It is soil-borne. A nematode, *Xiphinema americanum,* is suspected to be its vector. Quarantine regulations restrict the movement of susceptible host material and soil from infested properties and areas.

Control methods are in the experimental stage. Soil fumigation before replanting and possibly resistant rootstocks offer the most promise.

5. *Type of Pathogen:* Virus

Host: Potato, *Solanum tuberosum* Hort. var. Kennebec.

Name of Causal Pathogen: Potato stem mottle virus.

Common Name of Disease: Potato stem mottle.

Case History:
Location: Arvin, Kern County.
Date: May 19, 1959.
Type of planting: Commercial.
Location: Edison, Kern County.
Date: May 9, 1960.
Type of planting: Commercial.
Collector: Dr. J. W. Oswald, Dr. A. H. Gold, and Mr. T. Bowman, University of California.
Identified by: Dr. J. W. Oswald, Dr. A. H. Gold, and Mr. T. Bowman, University of California.

Nature and Degree of Infestation: This soil-borne virus was found in the Arvin District infesting a 3-4 acre portion of a commercial planting of Kennebec potatoes in May 1959. In the Edison District, the infestation was found to be heavy in a 50-acre commercial planting of Kennebec potatoes.

Description of Disease: Necrotic rings and arcs are found on the surface of the potato tubers. Dark necrotic tissue is found beneath the rings and arcs, sometimes extending as deep as ¼ inch into the flesh of the tuber. Necrotic flecks, not directly connected with surface markings, are found scattered throughout the flesh of the tuber. (Illustrations of the above described symptoms may be found in a letter to the county agricultural commissioners from the Bureau of Plant Pathology, dated March 21, 1958, entitled "A New Virus Disease of Potato in Monterey County").

General Information and Previous History:

Known Distribution:
California: (Salinas Valley), Monterey County.
Other states: A similar, possibly related, disease (corky ringspot) has been reported in Florida, Indiana, and Washington.
Elsewhere: Denmark, Germany, Holland, and Scotland.

Type of Habitat: Most severe in light sandy soils.

Known Host Range: The Kennebec variety of potato is the only plant that has been found to be naturally infected in California. However, the potato stem mottle virus has been inoculated into and produced symptoms on many herbaceous hosts in the greenhouse. In Europe it causes a disease of tobacco called "Tobacco Rattle."

Importance and Recommendations: The potato stem mottle affected potato tubers cannot be used for potato chip manufacturing since the internal necrotic discoloration darkens during processing to make an unsightly chip. Infected tubers should not be used as seed. Since the potato stem mottle virus is retained in the soil, fields known to be infested with the virus, should not be planted to potatoes of the variety Kennebec.

6. *Type of Pathogen:* Fungus

Host: Cauliflower, *Brassica oleracea* L. var. botrytis L.

Scientific Name of Causal Pathogen: Plasmodiophora brassicae Wor.

Common Name of Disease: Club root of crucifers.

Case History:
Location: Watsonville, Santa Cruz County.
Date: June 27, 1960.
Type of planting: Commercial

Collector: D. H. Shaw, Santa Cruz County Department of Agriculture.

Identified by: T. G. Scandone and C. G. Weigle, California Department of Agriculture.

Nature and Degree of Infestation: Found scattered throughout a 30-acre planting of cauliflower, 10 acres heavily infested.

Description of Disease: Roots of infected plant become overgrown or knotty, misshapen and clubbed. The aerial parts of the plant show retarded growth which usually is not noticeable until the disease is well advanced in the roots. (For further description and illustrations see California Department of Agriculture Bulletin Vol. 42, No. 3, pp. 113-118, July-August-September 1953.)

General Information and Previous History:

Known Distribution:

California: Under quarantine San Mateo County; infested areas of San Francisco and Marin Counties out of commercial crop production; infested areas in Alameda and Humboldt Counties (a single property in each) under hold order; eradicative measures taken in the very localized infested area in Monterey County and the disease is not now known to exist there.

Other states: Known to occur throughout the northern portion of the United States and is rarely found in the southern and southwestern portions.

Elsewhere: Worldwide.

Type of Habitat: Most severe on plants growing in acid soil and in poorly drained sections of fields.

Known Host Range: Only members of the mustard family (Cruciferae) are susceptible hosts. (For complete list of hosts see reference listed above.)

Importance and Recommendations: The club root is rated as an "A" pest and is under California Club root disease interior quarantine (Quarantine Regulation 16—Title 3, California Administrative Code, Section 3413). The fungus is extremely difficult to control or eradicate once it infests a field. The disease can be readily spread by any means which involves the movement of infested soil or infested plant materials. The club root organism usually remains viable in infested soil for many years. Long intervals between cruciferous crops give only partial control. Additions of lime to the soil may aid in reducing the amount of disease. The use of some of the newer soil fungicides during transplanting may give some protection against infection. Research on practical eradicative methods for field application is being carried out by the University of California, Berkeley.

7. *Type of Pathogen:* Nematode

Host: Eastern lily, *Lilium longiflorum* Thunb.

Scientific Name of Causal Pathogen: *Pratylenchus convallariae* Sienhorst, 1959.

Common Name of Disease: Root-lesion nematode injury.

Case History:

Location: Crescent City, Del Norte County.

Date: June 30, 1960.

Type of planting: Nursery.

Collector: L. J. Garrett, Jr., and T. O. Peacock, Del Norte County Department of Agriculture.

Identified by: Sadek M. Ayoub, California Department of Agriculture; confirmed by M. W. Allen, University of California, Davis.

Nature and Degree of Infestation: Nematodes extracted from roots and from soil surrounding roots of lily plants in the field.

Description of Disease: Similar to symptoms caused by other root-lesion nematodes on many hosts. Above-ground symptoms not distinctive, consisting of general debility, chlorosis or stunting. Shallow darkened lesions are produced in the root cortex and in bulb scales; in heavy attacks the lesions may lead to a serious root rot.

General Information and Previous History:

Known Distribution:

California: Alameda and San Mateo Counties.

Other states and elsewhere: Netherlands.

Types of Habitat: Previously reported only from nurseries and greenhouses growing Lily of-the-Valley.

Known Host Range: Lily-of-the-Valley (*Convallaria majalis* L.)

Importance and Recommendations: *Pratylenchus convallariae* is separated from *P. pratensis* by slight morphological differences which were not noted until Seinhorst's description of this new species in 1959 (Nematologica 4(1):83-86). It is very likely that many nematode populations previously identified as *P. pratensis* would properly be referred to as *P. convallariae* in light of this new information. *P. convallariae* has been rated a "C" pest along with *P. pratensis*.

Control measures for this nematode include sanitation and soil fumigation as recommended for other root-lesion nematodes.

Taxonomic Position of Parlatoria Virescens Maskell, and Descriptions of Related Species (Homoptera; Coccoidea; Diaspididae)

SCALE STUDIES—PART XIV

By HOWARD L. McKENZIE
University of California, Davis

This study was undertaken principally to clarify the systematic status of *Parlatoria virescens* Maskell, and to describe a new species of the same genus with which it is confused in collections made by A. Koebele in China. Koebele's specimens in question were subsequently turned over to Maskell for attention. The new species is a pest of fruit trees, infesting apple, pear, plum and peach in New Zealand. Since species of *Parlatoria* are of concern to the fruit industries of the world, it is advisable at this time to give a technical description of this hitherto undescribed species.

Two other new species of *Parlatoria* are also described in this publication. One is a pest of vanda orchids (*Vanda* sp.) and has been intercepted several times in quarantine from Honolulu, Hawaii. It is now established in a nursery in Los Angeles County, California. The other was found on wampi, *Clausena lansium* (Rutaceae) and was collected at Hong Kong, China, during a search for parasites of certain Parlatoriine scales.

It is an established fact that many *Parlatoria* species are encountered on plant material coming into the United States from foreign countries, and that several members of this group have already become successfully established in this country. The *Parlatoria* on vanda orchid from Honolulu, Hawaii, mentioned above appears to be another such case.

Present Status of *Parlatoria virescens* Maskell

Parlatoria proteus var. *virescens* was originally described by Maskell in 1897, and reported by him as—"In China, on *Myrtus* at Amoy, and on *Camellia* at Macao. . . ." In a second reference of that same year it was recorded by Maskell from collections made by Koebele—Numbers 1255, 1272, 1429, "on rose, Japan; on liliaceous plant, Formosa and on *Pyrus sinensis*, Hong Kong," and it was from specimens in lot 1429, then considered as type material or equivalent, that the species was redefined by the author in his 1945 revision of the group.

On February 2, 1959, the author received a letter from Dr. Harold Morrison, Coccidologist, United States Department of Agriculture, Agricultural Research Service, Entomology Research Division, Washington, D.C., indicating he was sending for possible identification a species of *Parlatoria* collected on pear in New Zealand. He further related that the species did not seem to come within the range of his experience but, after studying the author's 1945 revision on the genus *Parlatoria*, it seemed to him that it might be the form characterized as *Parlatoria virescens* Maskell.

According to Dr. Morrison, the only difficulty to identification under this name was that his concept of Maskell's *virescens*, based on specimens of the species included in the United States National Collection of Coccoidea as Maskell No. 521 (presumably "type" in the loose fashion in which Maskell maintained his collection) seemed to be different from this species described in my revision. Mounted examples of *virescens* were kindly loaned to the author by Dr. Morrison, and a comparison of this material, Maskell No. 521, has been made with specimens from Koebele's collections included under number 1429.

It seems quite obvious that two distinct species of *Parlatoria* are represented by the specimens now available from the Maskell collection, and by those from the Koebele lot No. 1429. A critical examination made by Dr. Morrison and the author of all available Maskell specimens on deposit in the United States collection of coccoidea, indicates these are nothing more than *Parlatoria camelliae* Comstock, possibly representing the collection "on *Camellia* at Macao" which

PLATE I *Parlatoria camelliae* Comstock (*Parlatoria virescens* Maskell) Photo micrograph of one of the Maskell *virescens* pygidia (Maskell No. 521), kindly loaned to the author by Dr. Harold Morrison, Coccidologist, Washington, D. C.

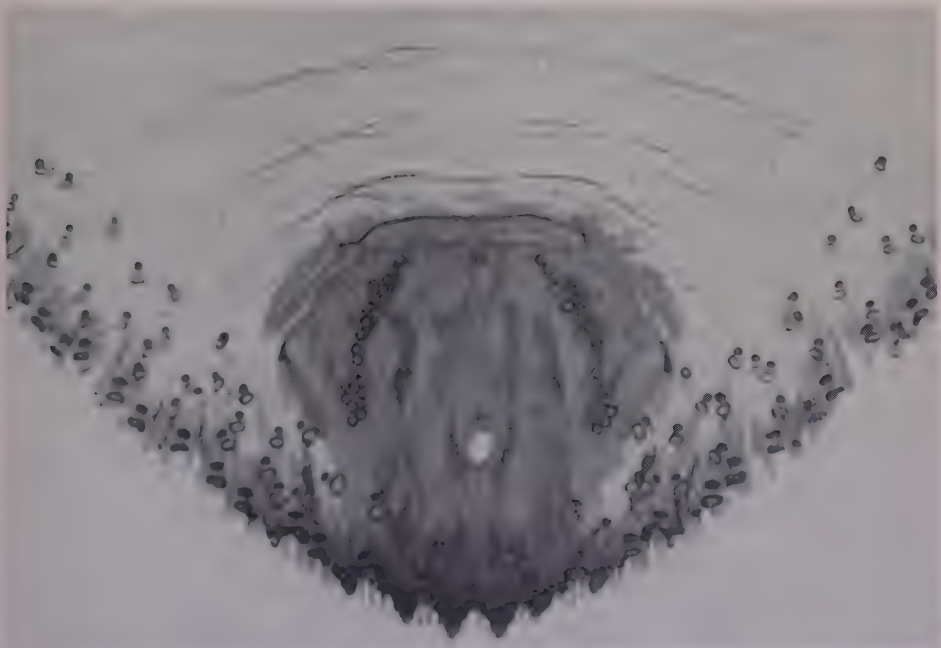


PLATE II Pygidium of *Parlatoria desolator* McKenzie, new species, collected on pear, Henderson, New Zealand, by H. G. King.

Maskell mentions in his original description of *virescens* (Plates I and III). The presence or absence of the posterior derm pocket remains indeterminate in specimens studied, although the pygidial fringe seems to agree quite well with accepted *camelliae* specimens. There is considerable variability in the exact outline and degree of sclerotization of the fourth and fifth pygidial lobes, both in specimens placed as *camelliae* and in the few Maskell *virescens* specimens; also, dorsal microducts are present above the anterio-lateral perivulvar pores and on the segment preceding just as in *camelliae* (see Plate I). After examination of the Maskell *virescens* specimens neither Dr. Morrison nor the author is willing to sponsor this as a valid and distinct species. Instead both are inclined to identify these specimens as *camelliae*.

The second species included in Koebele collection No. 1429 is apparently an undescribed one and, furthermore, it appears to be identical with the *Parlatoria* infesting pear in New Zealand. A technical description of this species follows:

PARLATORIA DESOLATOR McKENZIE NEW SPECIES

Plate II

1897. *Parlatoria proteus* var. *virescens* Maskell, Entomologists Monthly Magazine 33:241 (misidentification).

1945. *Parlatoria virescens* Maskell, McKenzie, Microentomology 10(2):75-76, illus. (misidentification).

1952. *Parlatoria virescens* Maskell, McKenzie, Bulletin Department of Agriculture, State of California 41(1):16 (misidentification).

Hosts and Distribution: Type and paratype mounted adult female specimens of this species are at hand from pear, *Pyrus communis* (Rosaceae), Henderson, New Zealand, collected January 9, 1959, by H. G. King. Additional mounted paratype specimens are available taken from Koebele's collection No. 1429, on "myrtle" (Myrtaceae), Amoy, China, collected October 1895, and from *Pyrus sinensis* (Rosaceae), Hong Kong, China, Koebele's collection No. 1429, so labeled.

Habit: Specimens occur on stems of host. Scale of the adult female approximately 1.50 mm. long, 0.75 mm. wide, moderately convex, grayish-brown, exuviae blackish. Scale of the male elongate and similar in color to that of adult female.

Recognition Characters: Scale of the adult female as mounted ranging from 0.75 mm. to 1.00 mm., width from 0.65 mm. to 0.70 mm. Moderate number of submarginal macroducts present, tabulated range from 23 to 43, with an average of 29 on each side in material studied; no intermediate ones observed, although a row of 20 or 30 intermediate dorsal microducts are normally present on the fourth abdominal segment. Three pairs of well-developed pygidial lobes present, giving an appearance of slight convergence apically toward meson, the median pair largest, notched once or twice internally and usually two or three times externally; second and third pygidial lobes progressively smaller, inner margins usually slightly once-notched quite near apices of lobe and practically parallel with pygidial axis, outer margins with usually two or three notches, notches in all lobes sometimes reduced or increased in number; fourth pygidial lobes less than one-half size of either median or second lobes, represented by a short, sclerotized, conical projection of pygidial margin and usually once-notched on inner margin, two or three times notched on outer margin; fifth lobes represented by membranous extensions of pygidial margin closely simulating the adjacent plates, but varying considerably in size, shape, and extent of fimbriation in specimens examined. Pygidial plates between the fully developed pygidial lobes elongate and slender, each narrowing and with roughly parallel sides, variously fimbriate at apex; three plates between third and fourth lobes broad, especially the intermediate one, and similarly fimbriate along apical margin; plates continuing to posterior corner of first abdominal segment normally shorter and more irregularly fimbriate or broad at base and tapering to a pointed apex. Anal opening slightly below middle of pygidium. Vulva anterior to pygidium center. Perivulvar pores normally in four distinct groups, infrequently 1 or 2 anterior median ones observed, anterior laterals in specimens tabulated, range from 9 to 12, average 10.0, posterior laterals from 7 to 13, average 11.0.

Prosoma membranous with ventral duct tubercles present, tabulated range on each half of body, prespiracular 3 to 6, average 3.9, anterior spiracular 2 to 5, average 4.0, intermediate 4 to 9, average 6.4, posterior spiracular 1 to 6, average 4.4, and first abdominal 1 to 4, average 2.8 (see Plate IV). Eyespot, in heavily stained specimens, shows

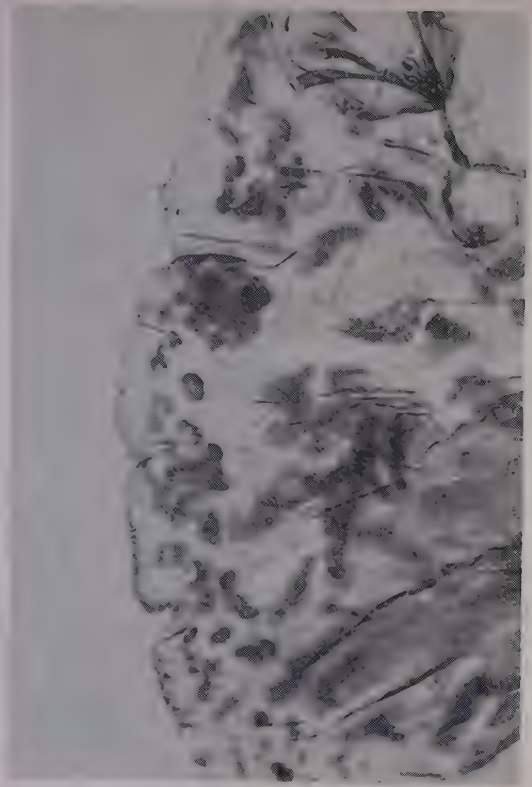


PLATE III. *Parlatoria camelliae* Comstock (= *Parlatoria virescens* Maskell). Photomicrograph of spiracular-body margin areas of one of the Maskell *virescens* examples (Maskell No. 521), showing prespiracular, anterior spiracular, intermediate, posterior spiracular and first abdominal duct tubercle clusters.

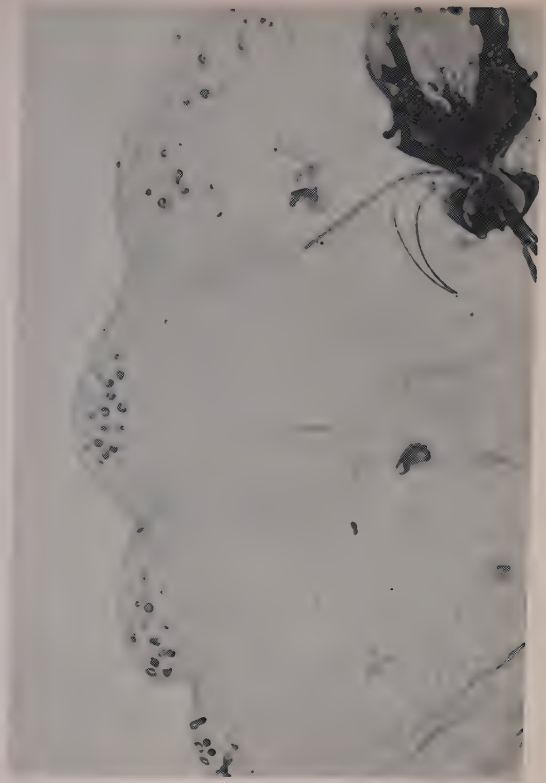


PLATE IV. Spiracular-body margin areas of *Parlatoria desolator* McKenzie, showing anterior spiracle with associated disk pores, and prespiracular, anterior spiracular, intermediate, posterior spiracular, first abdominal duct tubercle clusters, with associated small tubular ducts, and absence of derm pocket.

as a small, somewhat irregular, sclerotized area. Anterior spiracle with from 3 to 5 adjacent multilocular disk pores. Derm pocket between posterior spiracle and body margin lacking. NOTES: This species appears rather closely related to *Parlatoria fluggae* Hall in the character of the well-developed pygidial lobes which are noticeably notched on outer margins. It differs, however, in the possession of much broader and more fimbriate plates particularly between the third and fourth pygidial lobes, and fewer dorsal submarginal macroducts.

Type and paratype specimens of this species have been deposited in the Museum of the University of California, Department of Entomology and Parasitology, Davis, California. Paratypes have been sent to Washington, D.C., for the United States Department of Agriculture National Collection of Coccoidea, and to the collection of the California Department of Agriculture, Sacramento, California.

According to a letter from Mr. H. G. King of Henderson, New Zealand, *Parlatoria desolator* McKenzie, is considered to be a fruit pest commonly found on apple, pear, peach and plum in New Zealand.

PARLATORIA VANDAE McKENZIE, NEW SPECIES

Plate V

Hosts and Distribution. Type and paratype adult female specimens of this species have been collected from vanda orchids, *Vanda* sp. (Orchidaceae), Los Angeles, Los Angeles County, California, collected January 5, 1960, by A. Beresford (Calif. State Dept. Agr. #60A8-2). Additional mounted paratypes are available from vanda orchids intercepted in quarantine at Oroville, Butte County, California, from Honolulu, Hawaii, November 13, 1951, T. Crawford collector (Calif. State Dept. Agr. #51K43), and from *Vanda* sp. orchid intercepted in quarantine at South San Francisco, San Francisco County, California, from Honolulu, Hawaii, July 14, 1955, W. Davis collector (Calif. State Dept. Agr. #55G355). Dr. Harold Morrison recently (March 28, 1960) sent a single mounted adult female of this species intercepted in quarantine on *Vanda terres* (leaf) at Hoboken, New Jersey, from Canal Zone, October 1, 1946, Grayson collector (U.S. Dept. of Agr. #47-739).

Habit. Occurring on the leaves of orchid. Scale of the adult female approximately 1.25 mm. long, 0.90 mm. wide, quite flat, grayish-brown with exuviae a slightly darker brown.

Recognition Characters. Scale of the adult female as mounted ranging from 0.75 mm. to 0.85 mm. long, and from 0.50 mm. to 0.65 mm. wide. Relatively few dorsal submarginal macroducts present, tabulated range from 12 to 28, with an average of 20.5 on each side in material studied; no intermediate ones observed, although usually 2 or 3 intermediate dorsal microducts are present on fourth abdominal segment. Three pairs of normally developed pygidial lobes present, plainly graduated in size from median to outer, median pair largest, distinctly notched on outer margin, slightly notched if at all on inner margin; fourth and fifth lobes represented by a definitely sclerotized asymmetrical short conical projection of body margin having usually 1 relatively large and conspicuous projecting tooth just inside its midline and some minute teeth on each side of this. Pygidial plates between the three pairs of fully developed lobes rather slender and with roughly parallel sides, strongly fimbriate at apices, but usually with one projection longer and more prominent than the others, the 3 plates between third and fourth lobes broad, especially the intermediate one, and similarly fimbriate along apical margin; 3 of the 4 plates between fourth and fifth lobes also broad, but fimbriations fewer, shorter, and stouter, the fourth plate more slender; plates continuing to posterior corner of first abdominal segment mostly short, stout at base, rounded, tapering to a single projection of moderate length. Anal opening slightly below middle of pygidium. Vulva anterior to pygidium center. Perivulvar pores normally in four distinct groups, one specimen showing 1 anterior median 1 present, anterior laterals in specimens tabulated, range from 4 to 8, average 5.8, posterior laterals from 4 to 7, average 5.3.

Prosoma membranous with ventral duct tubercles present, tabulated range on each half of body, prespiracular 0 to 2, average 1.0, anterior spiracular 1 to 5, average 3.0, intermediate 1 to 3, average 1.8, posterior spiracular 1 to 3, average 1.8, and first abdominal 0 to 3, average 1.9 (see Plate VII). Eyespot not observed. Anterior spiracles with 2 or 3 adjacent multilocular disk pores; posterior spiracles without any trace of an adjacent derm pocket but with 2 to several small tubular ducts scattered between opening and body margin.

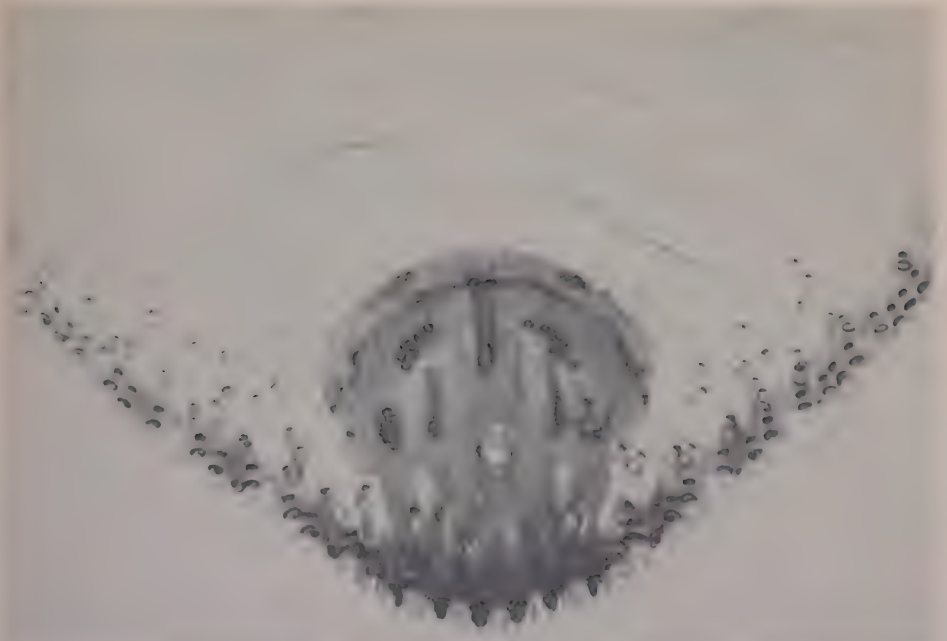


PLATE V. Pygidium of *Parlatoria vandae* McKenzie, new species, collected on orchid, *Vanda*, sp., Los Angeles, Armacost and Royston Nursery, Los Angeles County, California, by A. Beresford.

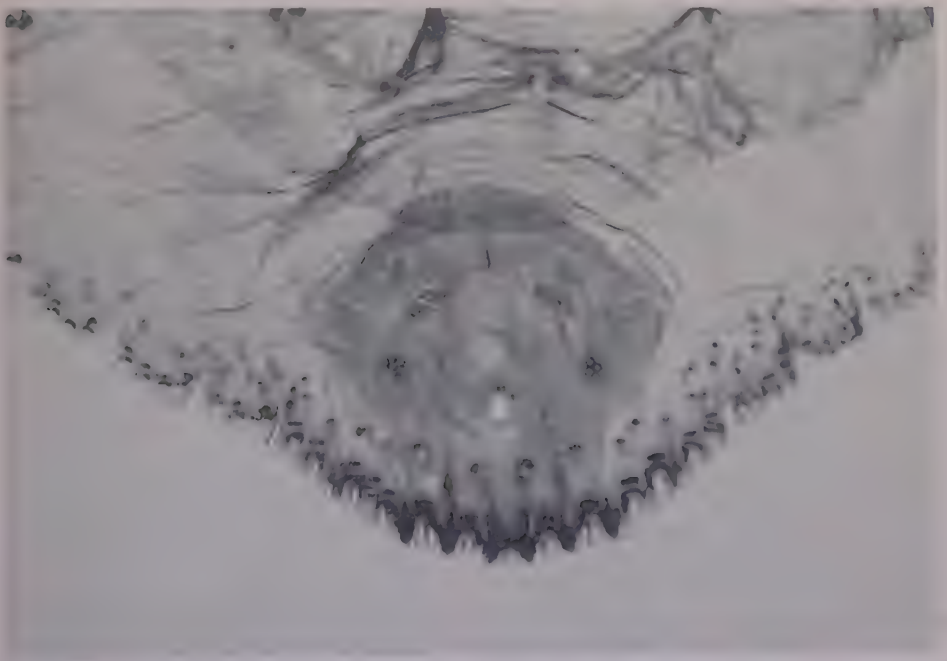


PLATE VI. Pygidium of *Parlatoria acalcarata* McKenzie, new species, collected on *Clausena lansium* (Rutaceae), Hong Kong, China, by S. K. Cheng. A dorsal macroduct is normally present on margin between median pygidial lobes.

PLATE VII. Spiracular-body margin areas of *Parlatoria vandae* McKenzie, showing anterior spiracle with associated disk pores, prespiracular, anterior spiracular, intermediate, posterior spiracular, and first abdominal duct tubercle clusters, with associated small tubular ducts, and absence of derm pocket.

PLATE VIII. Spiracular-body margin areas of *Parlatoria acalcarata* McKenzie, showing anterior spiracle with associated disk pores, prespiracular, anterior spiracular, intermediate, posterior spiracular, and first abdominal duct tubercle clusters, with small tubular ducts, and associated derm pocket between posterior spiracle and body margin.

Notes: This species is very similar to *Parlatoria pergandii* Comstock, particularly in the character of the pygidial fringe, but it differs in having fewer dorsal submarginal macroducts on pygidium, tabulated range on each half of body from 12 to 28, average 20.5, as compared to from 29 to 70, with an average of around 50 in *pergandii*. *Parlatoria vandae* McKenzie also appears to be host specific on *Vanda* orchid, whereas accurate records of *pergandii* indicate that it has not been found on orchid and that it is a more general feeder.

Type and paratype adult female specimens of this species have been placed in the Museum Collection of the University of California, Department of Entomology and Parasitology, Davis, California. Paratypes have been deposited in the collection of the California Department of Agriculture, Sacramento, California. Paratypes have been sent to Washington, D.C., for the United States Department of Agriculture National Collection of Coccoidea.

PARLATORIA ACALCARATA McKENZIE NEW SPECIES

Plate VI

Hosts and Distribution. Type and paratype adult female specimens of this species have been collected from *Clausena lansium* (Rutaceae), Hong Kong, China, February 14, 1957, by S. K. Cheng (University of California, Citrus Experiment Station, S. & R. No. 1690). Dr. Harold Morrison recently (March 28, 1960) sent a single mounted adult female of this species collected on *Microdesmis casearíaefolia* (Euphorbiaceae) at Canton, China (Canton Christian College), December 3, 1918, by C. W. Howard (United States Department of Agriculture #136).

Habit. Presumably collected on the twigs of its host. No other information available.

Recognition Characters. Scale of the adult female as mounted ranging from 0.50 mm. to 0.70 mm. long, to 0.45 mm. to 0.55 mm. wide. Relatively few dorsal submarginal macroducts present, tabulated range from 21 to 30, with an average of 25.0 on each side in material studied; no intermediate or median macroducts; and with normally only 1 or 2 microducts above anterior lateral perivulvar pores, well within the dorsal sclerotized area of pygidium, and characteristically with 3 to 5 such microducts on preceding segment along anterior edge of this sclerotization. Three pairs of normally developed pygidial lobes present, all approximately the same size, median pair distinctly notched on each side, second and third pair distinctly notched on outer margin, slightly notched if at all on inner margin; fourth and fifth lobes represented by projections of pygidial margin that closely simulate adjacent plates but are usually smaller and somewhat variable in details of outline, basal constriction, and extent of fimbriation. Pygidial plates between the three pairs of fully developed lobes rather slender and with roughly parallel sides, strongly fimbriate at apices, but usually with one projection longer and more prominent than the others, those outside of third lobes up to fifth lobes broad and short in comparison with those of some other species. Anal opening slightly below middle of pygidium. Vulva anterior to pygidium center. Perivulvar pores, as far as observed, constantly in four small groups, material critically examined showing a range in anterior laterals of 6 to 7, average 6.1, in posterior laterals of 5 to 7, average 6.0.

Prosoma membranous with ventral duct tubercles present, tabulated range on each half of body, prespiracular 0 to 2, average 1.0, anterior spiracular 0 to 4, average 2.0, intermediate 1 to 3, average 2.2, posterior spiracular 1 to 6, average 3.3, and first abdominal 0 to 3, average 1.7 (see Plate VIII). Eyespot not developed as a spur or otherwise, completely lacking in specimens examined. Anterior spiracles with 2 or 3 adjacent multilocular disk pores; posterior spiracles with a relatively distinct and conspicuous derm pocket situated about half way to the body margin (see Plate VIII).

Notes. This form is nearly a twin species of *Parlatoria proteus* Curtis, but it definitely appears to lack the eyespot modified to form a stout spur situated on prosoma about opposite mouthparts, a feature so characteristic of *proteus*. In addition, the new species appears to have generally more dorsal submarginal tubular macroducts, ranging in number from 21 to 30, with an average of about 25 on each side, as compared to normally fewer such structures in *proteus*, ranging from 11 to 25, with an average of about 18 on each half of body.

Type and paratype mounted adult females of this species have been deposited in the museum collection of the University of California, Department of Entomology and Parasitology, Davis, California, and a paratype has been sent to Washington, D.C., for the United States Department of Agriculture National Collection of Coccoidea.

Organization and Functions of the Bureau of Plant Pathology in the California Department of Agriculture

By GILBERT L. STOUT, *Chief*
Bureau of Plant Pathology

The Bureau of Plant Pathology is concerned with the infectious diseases of plants with particular reference to regulatory work pertaining to them under the provisions of the Agricultural Code of California. The bureau's duties involve the detection, suppression, eradication, and the prevention of the introduction and spread of such diseases.

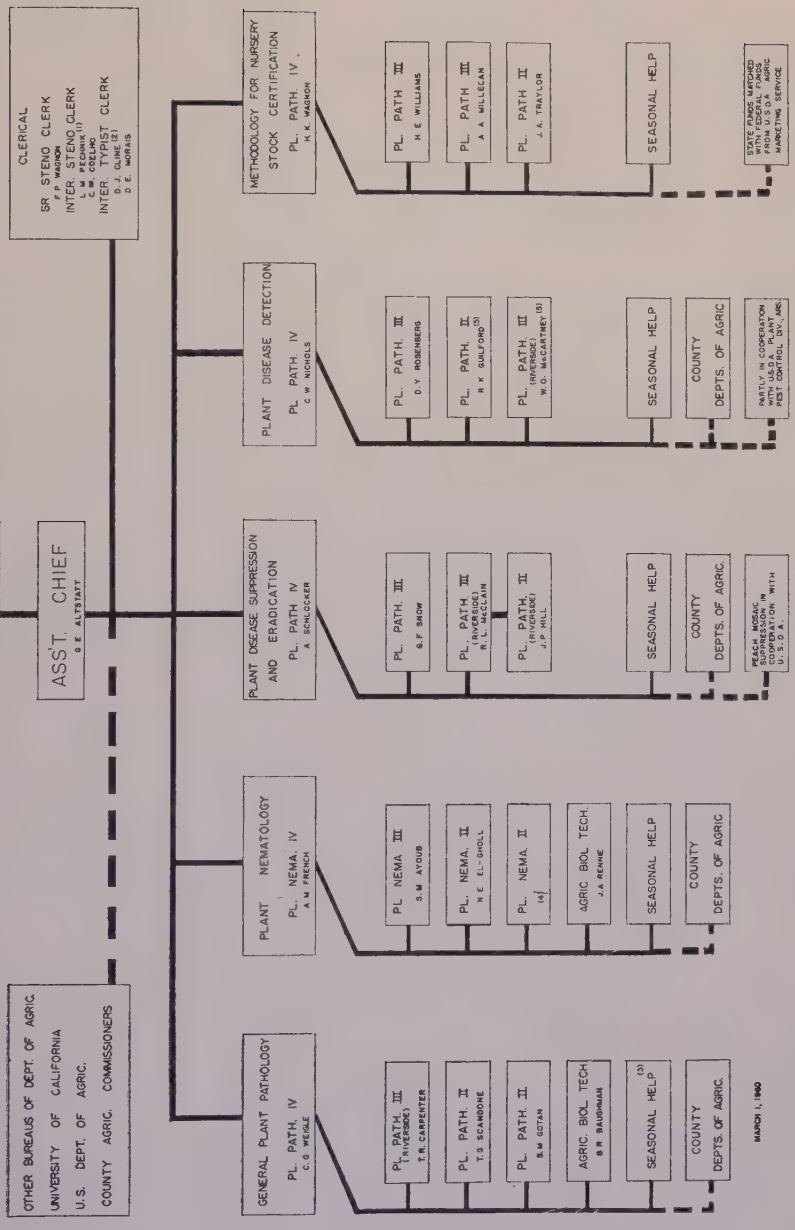
The primary function of the bureau is to act in a technical and advisory capacity to the agricultural commissioners in the county departments of agriculture and to those bureaus in the State Department of Agriculture which do law enforcement work involving plant diseases. It acts as consultant in plant disease matters to the Bureaus of Chemistry, Entomology, Field Crops, Fruit and Vegetable Standardization, Plant Quarantine, Nursery Service, Rodent and Weed Control and Seed Inspection, and Shipping Point Inspection. Assistance is rendered to these bureaus by providing plant disease diagnoses and information concerning specific diseases. Some examples include technical assistance and advice to the Bureau of Nursery Service in its strawberry, grape, cherry and other plant certification programs and to the Bureau of Fruit and Vegetable Standardization in its work with seed potato certification. Field surveys conducted in cooperation with the counties to determine the distribution of plant diseases provide information to the Bureau of Plant Quarantine for establishment of quarantine lines, and technical assistance is rendered to that bureau in its various quarantine problems.

GILBERT L. STOUT

Leadership and co-ordination as well as technical services are supplied in co-operative work with the counties. A working relationship is maintained with the U.S. Department of Agriculture and with the county departments of agriculture in survey, suppression and eradication work for specific diseases. The bureau operates or participates in extensive survey and field projects in cooperation with these agencies.

Diagnostic laboratories are maintained at Sacramento and at Riverside. During the calendar year 1959, specimens received in the Sacramento laboratory for diagnosis totaled nearly 10,000 and approximately 600 additional specimens were received in the Riverside laboratory.

Particular attention is given by the bureau to the detection and suppression of new diseases. State law requires, in Section 119.5 of the Agricultural Code of California, that any person employed by any agency or institution supported or financed from public funds must report to the commissioner of the county or to the Director of Agriculture, either directly or through the employee's superior, the presence of any new



Organization Chart, Bureau of Plant Pathology. The bureau is a part of the Division of Plant Industry. See Quarterly Bulletin, Vol. XLIX, No. 1, pp. 14-15.

(1) Paid from federal-state matching funds of AMS project.

(2) Hqs.-Riverside. Supervised by Plant Pathologist III.

(3) Seasonal personnel in bureau employed as needed; may be directed by project supervisors.

(4) Effective July 1, 1960.

(5) Incumbent now serving in Grade I.

pest found in the course of the employee's work. This means that all plant pathologists and other persons in California paid from public funds must report all new diseases, including diseases already present in the State but found in new areas in the State. When such diseases are discovered and reported it is the bureau's responsibility to evaluate them and undertake suppressive and eradicative measures when indicated. In the absence of information needed to carry on such measures and normally supplied by research agencies, suitable measures must be devised according to the exigency of the case.

Research is not a primary function of the bureau, but current knowledge of the results of research is highly essential to its activities. Sometimes it becomes necessary to improve existing techniques or develop new techniques or make investigations on specific diseases in order to obtain needed information not otherwise available. The bureau endeavors to keep in touch with new developments in plant pathology and to work in close co-operation with the various research agencies, including those in the University of California, the U.S. Department of Agriculture, experiment stations of other states, industry, and those in other countries.

The bureau operates a project for the development of methods and techniques for certification of nursery stock and plant propagating materials for freedom from serious virus diseases. This work is conducted under authority of the Federal Agricultural Marketing Act of 1946 and complementary state legislation. For the support of this project, state funds are matched with federal funds received from the U.S.D.A. Agricultural Marketing Service.

The permanent staff of the bureau currently consists of 18 plant pathologists, four plant nematologists, two agricultural biological technicians, and five stenographer-clerks. Temporary and seasonal personnel approximates 13 additional employee years.

Seven of the bureau's 22 plant pathologists and plant nematologists have doctoral degrees and all of the others, except two, have at least a master's degree or equivalent in graduate training. They have received their graduate training in such institutions as the Universities of Arizona, California, Cornell, Illinois, Iowa State, Michigan, Michigan State, Oklahoma A & M, Oregon State, Purdue, Stanford, and Utah.

A continuing organized inservice training is in effect. One employee of the bureau is designated as inservice training co-ordinator and the entire bureau staff is called together twice each year for a three-day inservice training conference. During these conferences instruction is given and work shop sessions are carried on pertaining to such subjects as public relations, interemployee relationships, interviewing techniques, overall policies and procedures. These conferences also include progress reports on bureau projects and activities and discussion and consideration of the technical work of the bureau as well as presentations by specialists from outside of the bureau.

SUMMARY OF 1959 GROSS VALUES OF CROP AND LIVESTOCK PRODUCTION REPORTED BY CALIFORNIA COUNTY AGRICULTURAL COMMISSIONERS AND LOS ANGELES COUNTY LIVESTOCK DEPARTMENT

(In thousands of dollars)

The gross value of agricultural production reported to the California Department of Agriculture by county agricultural commissioners totals $3,602,758,000 for 1959. This gross value should not be confused with the official estimate of cash receipts from farming of $3 billion for 1959 previously published by the California Department of Agriculture.

Reports of cash farm receipts are available only on a state basis. The data relating to gross value of agricultural production are published to fill a need for county statistics. The total of these county data exceeds cash receipts from farming for several reasons. The most important difference is that gross value reflects total value of production whether sold or used on farms where grown. Gross value figures for many counties include the value of natural and/or irrigated pasture. Another difference is that gross value often includes packaging and other costs not incurred by farmers. It also is generally on a crop year, rather than a calendar year, basis.

(Some adjustments to reported data were made to obtain approximate uniformity of commodity classification and totals.)

County	*Field and seed crops*	*Vegetable, melon and potato crops*	*Fruit and nut crops*	*Livestock and poultry*	*Nursery, cut flowers and misc.*	*Total*
Del Norte	285	3	8	1,459	1,088	2,843
Humboldt	76	141	39	9,568	650	10,474
Mendocino	490	---	3,076	3,384	---	6,950
Shasta	3,107	29	176	7,681	1,003	11,996
Siskiyou	10,203	2,915	---	7,859	191	21,168
Trinity *	---	---	---	---	---	---
Lassen	3,002	15	---	5,159	8	8,184
Modoc	5,726	4,259	---	6,188	---	16,173
Plumas	2,417	1	10	2,280	1	4,709
Alameda	2,706	10,448	2,344	10,203	8,163	33,864
Contra Costa	2,782	5,253	7,462	4,985	2,254	22,736
Lake	963	---	4,296	1,594	---	6,853
Marin	893	18	11	13,691	267	14,880
Monterey	21,202	70,759	12,825	15,824	17	120,627
Napa	428	---	5,449	12,227	162	18,266
San Benito	2,732	3,648	7,320	6,864	---	20,564
San Francisco	---	19	---	---	2,151	2,170
San Luis Obispo	10,070	12,824	3,097	26,998	12	53,001
San Mateo	751	4,951	269	2,779	9,068	17,818
Santa Clara	2,847	10,278	48,009	24,052	10,670	95,856
Santa Cruz	729	10,213	16,222	6,068	2,339	35,571
Sonoma	5,124	400	14,431	50,374	680	71,009
Butte	22,613	1,167	15,519	14,564	324	54,187
Colusa	19,720	372	4,946	5,610	92	30,740
Glenn	19,991	---	4,204	18,531	138	42,864
Sacramento	24,630	3,248	8,097	21,153	1,158	58,286
Solano	13,084	3,996	7,855	10,381	35	35,351
Sutter	23,646	3,310	18,789	4,146	536	50,427
Tehama	4,669	74	3,735	9,864	764	19,106
Yolo	46,146	13,245	7,066	9,271	108	75,836
Yuba	4,047	748	7,003	6,340	24	18,162

County	Field and seed crops	Vegetable, melon and potato crops	Fruit and nut crops	Livestock and poultry	Nursery, cut flowers and misc.	Total
Fresno	171,110	20,779	127,064	64,055	737	383,745
Kern	154,643	46,933	27,759	34,614	3,570	267,519
Kings	65,922	2,267	4,105	23,065	126	95,485
Madera	30,712	1,550	10,396	22,683	107	65,448
Merced	38,452	10,607	15,022	47,517	4,092	115,690
San Joaquin	40,870	45,528	44,026	37,461	1,544	169,429
Stanislaus	27,254	18,132	25,559	57,442	1,916	130,303
Tulare	97,314	6,498	123,103	111,367	3,363	341,645
Alpine *	---	---	---	---	---	---
Amador	521	12	161	1,979	2	2,675
Calaveras	1,759	7	221	3,469	10	5,466
El Dorado	775	---	5,084	2,721	103	8,683
Inyo *	---	---	---	---	---	---
Mariposa *	---	---	---	---	---	---
Mono *	---	---	---	---	---	---
Nevada	419	8	388	1,913	25	2,753
Placer	3,370	---	6,778	7,241	873	18,262
Sierra	647	---	11	692	---	1,350
Tuolumne	609	2	112	4,570	12	5,305
Imperial	75,692	35,040	503	25,924	289	137,448
Los Angeles	11,349	18,297	18,568	118,955	38,138	205,307
Orange	5,108	16,545	44,274	43,665	3,889	113,481
Riverside	22,439	33,044	38,908	55,627	4,093	154,111
San Bernardino	5,139	4,853	29,207	74,932	3,099	117,230
San Diego	2,052	36,317	15,521	46,434	9,275	109,599
Santa Barbara	10,814	18,195	12,373	24,376	2,642	68,400
Ventura	5,480	24,191	56,596	14,297	2,189	102,753
Total	1,027,529	501,139	807,997	1,144,096	121,997	3,602,758

* County does not have an Agricultural Commissioner.

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